EDICAL LIBRARY

JUL 20 1948

VOLUME 47 NUMBER 2

ARCHIVES OF

OTOLARYNGOLOGY

EDITORIAL BOARD

GEORGE M. COATES, Chief Editor
1721 Pine Street, Philadelphia 3

WESTLEY M. HUNT, New York
RALPH A. FENTON, Portland Ore.
ERNEST M. SEYDELL, Wichita, Kan.
CHEVALIER JACKSON, Philadelphia
ROBERT L. GOODALE, Boston
J. MACKENZIE BROWN, Los Angeles
CARL H. McCASKEY, Indianapolis

FEBRUARY 1948

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO 10, ILLINOIS. ANNUAL SUBSCRIPTION, $10.00

Entered as Second Class Matter Jan. 14, 1925, at the Postoffice at Chicago, Under the Act of Congress of March 3, 1879

COPYRIGHT, 1948, BY THE AMERICAN MEDICAL ASSOCIATION

CONTENTS OF PREVIOUS NUMBER

JANUARY 1948. NUMBER 1

The Question of Prothrombinopenic Hemorrhage from Post-Tonsillectomy Use of Chewing Gum Containing Acetylsalicylic Acid. George S. Livingston, M.D., Chicago, and Edward R. Neary, M.D., Newark, N.J.

Plastic Repair of the Obstructing Nasal Septum. Samuel Fomon, M.D.; Joseph G. Gilbert, M.D.; A. Gilbert Silver, M.D., and Victor Royce Syracuse, M.D., New York.

Chemical Meningitis Following Use of Tyrothricin: A Clinical and Experimental Study. Frank J. Otensaek, M.D., and David Fairman, M.D., Baltimore.

Nonvibratory Tinnitus: Factors Underlying Subaudible and Audible Irritations. Edmund Prince Fowler, M.D., New York.

Nasal Hemorrhage: Studies of Ascorbic Acid, Prothrombin and Vitamin K. Harry Neivert, M.D., and Recha Engelberg, Ph.D., New York, and Leo A. Pirk, Ph.D., Nutley, N. J.

Congenital Laryngeal Web: Its Eradication. David L. Poe, M.D., and Paul S. Seager, M.D., New York.

Morphologic Deformities of the Lower Lateral Cartilages. Jacob Daley, M.D., New York.

Case Reports:

Calcified Hematoma of the Oropharynx Secondary to a Gunshot Wound. Edward H. Diamond, M.D., and Charles W. Perkins, M.D., Norwalk, Conn.

Fibroma of the Trachea. John S. Knight, M.D., M.Sc. (Med.), and Williston P. Bunting, M.D., Kansas City, Mo.

Clinical Notes; New Instruments and Technics:

A Suggestion for Packing the Nose for Anesthesia. Major J. Jacob, Indian Army, Medical Corps.

Progress in Otolaryngology. Summaries of the Bibliographic Material Available in the Field of Otolaryngology:

The Paranasal Sinuses (To Be Concluded). Samuel Salinger, M.D., Chicago.

Abstracts from Current Literature.

Book Reviews.

Directory of Otolaryngologic Societies.

ARCHIVES OF OTOLARYNGOLOGY

VOLUME 47 FEBRUARY 1948 NUMBER 2

COPYRIGHT, 1948, BY THE AMERICAN MEDICAL ASSOCIATION

SOME CLINICAL PHENOMENA OF DEAFNESS IN THE LIGHT OF NEW AND OLD TESTS OF THE EAR

F. KOBRAK, M.D.
EDGWARE, MIDDLESEX, ENGLAND

THE unbiased reader of modern publications on functional tests of hearing cannot escape the conclusion that audiometry has conquered the field of hearing tests and that the tuning forks are doomed to be shelved as obsolete instruments, as interesting curiosities of otologic history. G. E. Shambaugh,[1] who took a critical view of hyperenthusiasm about the increasing monopoly of audiometry in 1930, was not mentioned among the numerous references in Bunch's work on "Clinical Audiometry," [2] in 1943. I, who have taken an active part in the development of functional tests of the ear since 1902 and found the opportunity to study audiometry on a large material since 1938, am the last to deny the revolutionary importance of audiometry, but I feel that a sound constructive antithesis of old and new tests might still be indicated and perhaps helpful in the approach to the problem of deafness, especially that of congenital deafness.

I. NOTES ON DIFFERENCES BETWEEN TUNING FORK TESTS AND AUDIOMETRY

Curves of tuning fork tests are frequently but not regularly in contrast to those of audiometry in the same case. As the physical inaccuracy in the estimation of the tonal intensity of the tuning fork threshold did not fully explain this contrast, the conclusion was drawn [3] that besides the factor of threshold a second factor must cooperate which causes the contrast between the tuning fork test and audiometry. Besides the sensitivity factor of threshold, common both to tuning fork and to audiometric tests, a second factor, of "efficiency," was claimed to be in action only with tuning forks—the function of hearing over a

1. Shambaugh, G. E.: Evaluation of Usefulness of Western Electric Audiometer in Solving Clinical Problems for Practicing Otologist, Acta oto-laryng. **14**:47, 1930.

2. Bunch, C. C.: Clinical Audiometry, St. Louis, C. V. Mosby Company, 1943.

3. (*a*) Kobrak, F.: Functional Tests of the Ear, Leipzig, Johann Ambrosius Barth, 1911; (*b*) Contributions to Functional Pathology of the Ear: Principles of Sensitivity and Efficiency of Ear, J. Laryng. & Otol. **59**:171, 1944.

certain period, briefly, "period hearing" (of a decaying tuning fork). Even by duly taking into account the different physical conditions of measuring tuning fork and audiometry thresholds, one can say that in cases in which the efficiency of period hearing is relatively not much more affected than the threshold sensitivity no striking difference between audiometry and tuning fork tests will arise. And no contrast between tuning fork tests and audiometry appears when the threshold sensitivity with tuning forks is determined by approximate direct estimation of sound intensity, by "loudness tests,"[4] independently of the estimation of period hearing; the loudness of the tuning fork at the moment when it ceases to sound in the patient's ear is approximately assessed by graduated intensities such as "very feeble," "feeble," "medium," "loud," or "very loud." These graduations give informative estimations of the intensities of threshold values, the physical accuracy of which is, of course, not equal to, but comparable with, that of audiometry. The interference of the factor of period hearing is excluded by holding the tuning fork not uninterruptedly to the ear but only at short intervals, of two seconds. The diagnostic reliability of these loudness tests is satisfactory in cases of more advanced deafness, in which a short orientation on low, middle and high scale hearing is attained by using one fork for each scale.

II. NOTES ON THE CLINICAL SIGNIFICANCE OF THE TYMPANIC MUSCLES: "PHYSIOLOGIC NEGATIVE RINNE TEST" AND "PROVOCATIVE NEGATIVE RINNE TEST"

Non-air-conducted hearing is called bone-conducted hearing. Non-air-conducted hearing is sometimes definitely less impaired than air-conducted hearing in spite of the absence of any morphologic changes in the middle ear which are regarded as the specific cause of middle ear phenomena in bone-conducted hearing. In ears free from morphologic changes, physiologic changes in the middle ear, imitating morphologic changes, were suspected and related to abnormal tension in the tympanic muscles.

"Physiologic Negative Rinne Test."—Pathophysiologic changes in the middle ear were first noted in cases of typical cochlear deafness (perceptive deafness) with definitely normal conditions on otoscopy and catheterism. The more or less pronounced negative result in the Rinne test in these cases was interpreted as a physiologic negative result caused by hyperactive (spastic) responses in the tympanic muscles to abnormal nerve stimuli in the eighth nerve.

4. Kobrak, F.: New Tests and Clinical Experiments on Hearing, J. Laryng. & Otol. **55**:405, 1940.

The "physiologic negative Rinne test" in cases in which the cochlea is abnormal can be experimentally produced, in cases in which this organ is normal, by the "provocative test."[5]

"Provocative Negative Rinne Test."—Exposure to the stimulus of abnormal noise is supposed to bring about hyperactivities in the tympanic muscles with a normal cochlea, as a correlate of the response of an abnormal cochlea to normal stimuli. When the right ear with normal hearing is exposed to the Barany buzzer at the left ear, most of the Rinne test figures—except those with the highest tones—become negative. There is a fairly quick recovery from the negative results after the exposure to noise. This indicates that no morphologic change takes place, but rather a physiologic change which is reasonably related to the tympanic muscles, as a damping mechanism protecting against noise.

The middle ear factor of cochlear deafness was well known but was misinterpreted before the era of audiometry. Physicians who principally used to do Rinne's and Schwabach's tests with two or three tuning forks at octave distance encountered not infrequently combinations of shortened bone conduction and a negative result of the Rinne test. The diagnosis of cochlear deafness plus middle ear "catarrh" was familiar but at least incorrect; the diagnosis of "combined internal and middle ear deafness" would have been accurate, by not anticipating the character of the changes of the middle ear. The consideration of a middle ear factor of cochlear deafness is not only an academic question; the middle ear factor related to the tympanic muscles seems to provide a clue to some therapy in cases of perceptive deafness.[6]

III. "FALSE RINNE TEST"

Eventuality of Vestibular Cooperation in Hearing.—In a case of a false result in Rinne's test, e. g. on the right side, i. e. with deafness in the right ear, the general opinion is that the location of the perception of the bone-conducted tone is only acoustically misinterpreted. Masking of the good ear is generally used to counteract the misinterpretation. As the false result of the Rinne test is usually regarded as a false localization of the sound, brought about by a mostly psychophysiologic error, a new binaural test was devised, in which the masking effect of the better ear is mainly psychologic and not so much physicophysiologic —as are the effects of the customary masking devices.

In cases in which a negative result of the audiometric Rinne test, e. g., of the right ear, was suspected to be a false result, an Edelmann

5. Kobrak, F.: The Provocative Test: A Mitigated Numbing Test, Based on the Susceptibility or Vulnerability of Noise, J. Laryng. & Otol. **58**:21, 1943.

6. Kobrak, F.: Contributions to Functional Pathology of the Ear: On Some Aspects of Treatment in Progressive Congenital Deafness, J. Laryng. & Otol. **58**:439, 1943.

tuning fork, say e^1, was put on the mastoid of the good (left) ear and the bone conduction receiver of the audiometer, sounding d^1, on the right mastoid. The tuning fork (left ear) was struck the maximum blow, and the audiometer (right ear) was sounded at only medium intensity, so that during the first phase of the decay of the tuning fork the intensity of the tuning fork tone (left ear) was definitely greater than that of the audiometer tone (right). During this first period of the binaural test the patient heard mostly one tone only, that on the left side. During a second stage he heard mostly the two different tones, moving to, and/or appearing at, the top of the head. During a third stage the tone of the tuning fork disappeared and only one tone, that of the audiometer, was heard, on the right side. Between these three stages there are, of course, transient stages, which are not mentioned, for the sake of simplification.

There was a definite wandering of sounding from the left (normal or subnormal) ear to the right (deaf) ear. The patient replied to the suggestive question of whether he really heard the tone in the right (deaf) ear with words like, "Well, I have certainly the impression," or so, of hearing the tone in the right ear. As said before, the psychologic error is psychologically counteracted in the binaural test by directing the auditory attention to the left ear in the first stage of the test and so diverting the attention from the right ear. Nevertheless, the tone was, as usually said, finally "localized in" the deaf ear (right). This sounds less paradoxic when one puts it this way: The patient has the definite sensation of a tone "coming from" the right side. This interpretation is sensible if one considers that, e. g., in Weber's test the tuning fork put on the top of the head is not, as generally said, heard at the top but rather "from the top." And so it is plausible that the tone which gives the false result in the Rinne test is obviously not "heard in the right ear" but is sensed "from the right side." This means a directional sensation. As this directional sensation can occur also in an ear which is absolutely deaf, it is justifiable to suggest that the directional sensation is dependent on specific directional sensitivity, and that the localization is due to some vestibular function in the cochlea. This vestibular function in the cochlea may be pertinent to certain conditions of everyday hearing, apart from the eventuality of this cochleovestibular function participating in elementary musical hearing; this is discussed in an article which is to be published elsewhere.[6a]

I agree with G. E. Shambaugh that not all that patients perceive by using the ear piece in audiometry is "hearing" through the eighth nerve. As an alternative, however, of Shambaugh's "tactile sensations via the trifacial nerve in which pitch can be accurately appreciated," tactile toneless cochleovestibular sensations are suggested on the basis of some vestibular directional sensitivity.[6a]

6a. Kobrak, F.: Observations on the Working Hypothesis of a Cochlear-Vestibular Hearing Principle, Pract. oto-rhino-laryng. 9:346, 1947.

IV. EARLY DIAGNOSIS OF CONGENITAL DEAFNESS

Members with "normal" hearing from the families in which deafness is, or is suspected to be, hereditary are mainly concerned here. The persons so far examined by me had normal hearing with reference to the practical demands of everyday life; the purpose of investigation was to see whether latent abnormalities could be detected by special tests on early diagnosis of deafness.

(*a*) *Routine Audiometry.*—When no complaints of hardness of hearing or of tinnitus were present, routine audiometry failed to trace any circumscribed or dispersed latent abnormality.

(*b*) *Tuning Fork Tests.*—Threshold tests, done either by loudness tests (part I) or by establishment of the ultimate threshold figures of steppage tests,[7] were not able to detect latent stages of deafness. Tuning fork tests on period hearing, however, were not infrequently suggestive. But an abnormality can be admitted only when the period of hearing sensation is, with 1024 or 2048 double vibrations per second, less than half the normal and then only when associated with other early symptoms (see under *c* and *d*).

(*c*) *Audiometric Provocative Test.*—A definitely positive result of the provocative Rinne test is suggestive of latent abnormality, more suggestive, according to experiences so far gained, than abnormal period hearing. In part II it was shown that if the cochlea is normal the result of the provocative Rinne test is negative. A definitely positive result is, therefore, a sign suggestive of latent abnormality.

(*d*) *Vestibular Tests.*—Vestibular abnormalities, mainly *Nystagmusbereitschaft* (Nystagmophilia),[8] have occurred in families in which deafness was hereditary. Vestibular abnormality is at least as suggestive as an abnormal provocative test according to the restricted number of family cases so far under control.

It is the task of further research to see how far abnormalities (see under *b*, *c* and *d*) overlap the range of normality and on which scale a combination of symptoms (*b*, *c* and *d*) secures a reasonable basis of diagnosis of latent congenital deafness.

V. HEREDITARY, CONGENITAL AND ACQUIRED DEAFNESS

Several patients bearing signs of latent deafness (part IV) were encountered who were near relatives of a patient whose history feigned conditions of acquired deafness but whose deafness was suspected to

7. Kobrak, F.: Studies of Activities of Intratympanic Muscles, J. Laryng. & Otol. **57**:418, 1943. Frey, H., in discussion on Kobrak, F. W.: A Study of the Activities of the Intratympanic Muscles, Proc. Roy. Soc. Med. **35**:793, 1942.

8. Kobrak, F.: Beiträge zur Lehre von den statischen Funkionen des menschlichen Körpers, Berlin, S. Karger, 1921; Studies on Vestibular Nystagmus, J. Laryng. & Otol. **58**:167, 1943; What is Nystagmusbereitschaft? Pract. Otol. **8**:25-36, 1946.

be congenital. The deafness in these patients is generally not called hereditary, because there is no manifest deafness in the family. The identification of latent congenital deafness necessitates the reconsideration of the terms "hereditary," "congenital" and "acquired." Although a basic division between congenital and hereditary deafness appears to be somewhat arbitrary, it is, for the purpose of easier understanding of the clinical situation and especially, perhaps, of the prognosis, suggested to refer the term "hereditary" to those cases in which next of kin show manifest deafness. The term "congenital" is suggested to apply to the deafness in persons in whom latent abnormalities of the genes can be detected by special methods of diagnosis. If internal ear deafness occurs, e. g., after measles or scarlatina or after one of the not infrequent small accidents of early childhood, it seems to be indicated to ascertain the hearing status of some next of kin before saying that the patient has simple "acquired" internal ear deafness (due to measles, scarlatina, childhood accident) or that the patient's condition is suggestive of congenital deafness (according to our tests on latent deafness). It is probable that the ratio of well established congenital deafness will increase with the improvement of early diagnosis of latent deafness.

Cases in which deafness cannot be identified as congenital by special tests are to be placed in the category of acquired deafness, which can be antenatal, intranatal or postnatal.

CONCLUSIONS

The audiometer is indispensable and the tuning fork is most helpful in hearing tests.

Early diagnosis of latent deafness depends not only on special hearing tests (audiometer and tuning forks) but also on vestibular tests, on spotting "mute" areas in the petrous bone.

The part of the tympanic muscles in hearing can be identified with high probability by the audiometric provocative test; vestibular cooperation in hearing, suggested by the findings of a combined audiometric and tuning fork test, is still hypothetic but worth consideration.

The distinction between "hereditary," "congenital" and "acquired" perceptive deafness is discussed, in view of the possibility of early diagnosis of lesions of the internal ear.

185 Hale Lane.

PROGRESS IN ESOPHAGOLOGY

PAUL H. HOLINGER, M.D
CHICAGO

ESOPHAGOLOGY is a term relatively recently introduced into medical nomenclature. It implies the existence of a medical specialty devoted to a study of the anatomy, the physiology and the pathology of the esophagus. The many aspects of these studies, the influence of related medical advances in other fields and the progress in the diagnosis and the management of diseases of the esophagus have justified the implications of the new term. Progress has been apparent in two ways: first, in the changing concept of esophageal diseases, and, second, in the more successful management of these diseases, the prognosis of which heretofore had been considered hopeless.

In many respects the progress in esophagology has been directly dependent on and parallel to the progress in esophagoscopy. Anesthesia, electrically illuminated esophagoscopes, standardized technics and radiologic guidance have all been outstanding steps in the development and the advancement of endoscopic procedure. In this regard it is of interest to note the frequency with which the progress of esophagoscopy is measured by the development of new instruments. Histories of esophagoscopy as a separate field of medicine are almost direct quotations of accounts of advancements in instrumentarium. This has some justification. New diagnostic instruments are followed in many instances by the development of therapeutic instruments which permit endoscopic treatment of the newly recognized disease entity. Thus, while esophagoscopy had its beginning with candlelight reflected down a tube, routine examination of the esophagus of the patient with symptoms of dysphagia awaited the development of the electrically lighted esophagoscope, and through its development the management of the diseases visualized has become one of the most challenging phases of endoscopy. A multitude of new instruments have been developed to meet new problems. Diagnostic as well as therapeutic

From the Department of Otolaryngology, University of Illinois College of Medicine; St. Luke's Hospital, and the Children's Memorial Hospital.

Read before the Section on Laryngology, Otology and Rhinology at the Ninety-Sixth Annual Session of the American Medical Association, in Atlantic City, N. J., June 11, 1947.

esophagoscopic procedures have, in this way, kept pace with the progress in bronchology.

Foreign bodies constituted the primary indication for esophagoscopy a generation ago, with over 95 per cent of esophagoscopies being performed for their removal. At present this relationship is reversed. Diagnostic problems constitute the principal indication for esophagoscopy, preceded by careful fluoroscopic and roentgenographic studies. A lack of positive roentgen findings is no reason to discontinue further search for pathologic changes if the patient's symptoms persist. Roentgen findings are often negative in the earliest phases of organic disease, the most opportune time for its eradication.

The patient with esophageal symptoms requires general medical studies in addition to those made roentgenologically and esophagoscopically. One of the most important contributions to esophagology is the concept that esophageal symptoms and pathologic conditions are often manifestations of systemic disease. In the vitamin deficiencies the mucous membrane, and in senility and the anemias the atrophic changes, it is now known, produce marked dysphagia, sometimes as the earliest subjective symptom of these conditions.

The development of specialized esophagoscopic technics is of interest. The many technics used in the dilation of strictures, supplemented by retrograde esophagoscopy for the recannulation of the atretic esophagus, are discussed on later pages. Dilation of the cardia, performed with endoscopic, pneumatic, hydrostatic or mercuric bougies in cases of cardiospasm, represents one of the most gratifying phases of esophagology. The patient who is able to swallow freely and easily, without retention or regurgitation, after months or even years of discomfort is one of the most grateful patients a physician can have. Esophagoscopic dilation is an important procedure in the management of this condition, aiding in the diagnosis of associated ulceration or malignant growth, and establishing the primary diagnosis with certainty. Palliative implanting of radon in inoperable carcinoma to prolong swallowing function and life should also be mentioned. Direct visualization and injection of esophageal varices present another phase of esophagoscopy which has recently become an important adjunct in the management of the hemorrhages that occur in patients with hepatic cirrhosis. Yet another phase of esophagoscopy is that in which the esophagoscopist assists in the removal of the hypopharyngeal diverticulum by clearing the sac, presenting it in the cervical incision and delineating its upper and lower attachments as he advances the esophagoscope into the subdiverticular part of the esophagus.

A discussion of the ways in which esophagoscopy has affected progress in esophagology would hardly be complete at this time without referring to the growing problem of the choice of the esophagoscopist.

Without question, the field was pioneered and developed by the otolaryngologist who, through his manual dexterity and his training in monocular vision, mastered the technical problems of the various endoscopic procedures. Yet in a growing number of instances the gastroenterologist has added esophagoscopy to his diagnostic armamentarium. The thoracic surgeon with possibly even greater justification has become an esophagoscopist in order that he may personally observe his patient by endoscopic as well as every other means at his disposal prior to a surgical procedure. There is no question but that the greatest recent progress made in esophagology has been made in the surgical division of this field. It is up to the otolaryngologist, then, as the pioneer and leader, to share his knowledge with his surgical team mate, and make available to the latter the technics of safe esophagoscopy which he has developed.

Probably in no way could the advances in the technic of esophagoscopy be shown more clearly than by referring to the management of foreign bodies in the esophagus. Reports in the literature of fifty years ago indicated a mortality due to foreign bodies of approximately 25 per cent. Recent comprehensive surveys have shown the rate reduced to less than 0.5 per cent. This reduction may in part be attributed to the great diagnostic aid of roentgenology, but it is primarily due to the recognition of the fact that the esophagus and its diseases constitute an important branch of medicine requiring special training; instruments, equipment and facilities for safe endoscopic work. Esophagoscopy done by a trained team with an adequate instrumentarium is no longer a dangerous procedure, considered only as a last resort. In trained hands, it has become a routine diagnostic adjunct in the practice of medicine, complementing rather than substituting for other recognized procedures. Foreign body technics have been developed together with special esophagoscopes and forceps for unusual mechanical problems, with constant stress being placed on the importance of insuring safety to the patient in their use. The probangs and other instruments introduced blindly, the use of which so often resulted in perforations, have been abandoned as obsolete and dangerous and substituted by instruments controlled under direct vision. In unusual cases, or in cases in which the foreign body is large, irregular, sharp or embedded, the great advantage of biplane fluoroscopic assistance to guide the forceps and check their grasp may be obtained. Such assistance adds even greater certainty to the success of the procedure, provided one adheres to the usual necessary precautions and safety measures.

The esophageal foreign bodies found in adults remain essentially the same as they have been in the past, namely, bones, meat and dentures. In children there has been a significant change since the

Pure Food and Drug Acts have made it illegal to incorporate nonedible objects, such as small toys, in containers holding food, candy or popcorn; this has resulted in a marked decrease in the number of metallic toys swallowed. However, there is an increasing number of children who have swallowed the friable, brittle plastic toys or parts of toys, which become lodged in the esophagus. These foreign bodies present a more difficult problem of diagnosis because they are not radiopaque. Preliminary examinations are therefore more difficult, and occasionally even the most careful studies prior to esophagoscopy do not give accurate information regarding the size and the configuration of the object. Such information must be obtained at the time of esophagoscopy.

The greatest progress in esophagology in recent years has been that of the surgery of the esophagus. Until recently the esophagus was not approachable by means of an external surgical procedure except for drainage following infection or trauma. The advances made in thoracic surgery, in conjunction with those in chemotherapeutics, anesthesiology and radiology, and the exactitude of diagnosis attained through esophagoscopy have most dramatically changed this conception.

Congenital atresias of the esophagus afford one of the most outstanding examples of this surgical influence. Until eight years ago, all infants born with this anomaly died within the first few weeks of life. Gastrostomy, jejunostomy, ligation of the cardia and other procedures were all to no avail. The first of these infants to survive did so because of a combination of procedures consisting of the establishment of a cervical esophageal fistula following gastrostomy and ligation of the cardia. Eventually, an antethoracic or subcutaneous esophagus was constructed to link the esophageal fistula of the neck with the gastrostomy. Now this procedure has been supplanted by another step in surgical progress, the direct anastomosis of the upper and lower segments of the atretic esophagus. The operative and postoperative mortality has been reduced to less than 25 per cent, with no operative deaths in the last 6 consecutive cases of one series recently reported. The lower segment, most frequently connected to the trachea, often presents a serious problem, since it is short and stenotic. In such instances the next step may become necessary: anastomosing the stomach to the upper segment, a procedure now reserved for patients older than the 2 to 3 day old, 5 to 7 pound (2,268 to 3,175 Gm.) infants on whom this formidable surgical operation must be performed if life is to be saved.

Atresias acquired through the ingestion of caustic agents present problems similar to those of the congenital lesions. The patients are older, but often prolonged starvation and malnutrition have rendered them as poor surgical risks as the infants described. Gastrostomy

was formerly their only means of obtaining nourishment. At present, recannulation of the esophagus is possible by endoscopic means in most instances. The assistance of the biplane fluoroscope has increased the percentage of cases in which the atretic esophagus can be reopened by this means. Endoscopic recannulation has been combined by some with an external surgical procedure, the needle used in the recannulation being guided through the scarred remnants of the esophagus in the mediastinal bed through the opened chest. The construction of a subcutaneous esophagus, through use of a skin tube flap or through transplantation of a segment of intestine, has been resorted to in patients in whom the atresia extended over too long a course to permit use of the aforementioned procedure. Another alternative, representing a distinct improvement over the antethoracic procedure, has even more recently been adapted to the correction of this condition. An anastomosis has been made between the stomach and the upper part of the esophagus, with resection of the lower two thirds of the esophagus, in a number of instances. This is satisfactory if the stomach is freely movable and if there is no stricture at the entrance of the esophagus.

Cardiospasm responds readily in most instances to simple dilation, bougies filled with air, water or mercury being used in this treatment. However, in long-standing cases, fibrosis develops in conjunction with extreme achalasia. In these cases surgical anastomosis of the stomach and the distal part of the esophagus is now feasible and is another important step in the progress of esophagology. The etiology of the cardiospasm is still obscure, and further progress in the management of this condition depends on the newer anatomic and physiologic studies of the esophagus. Such studies are gaining impetus because of the interest in section of the vagus nerve as applied to peptic ulcer of the stomach. It is important to note at this time that cardiospasm may be produced by sectioning the vagus nerve, an observation adding significantly to the concept of this disease. It is generally only temporary but is significant from a physiologic point of view. The great variation of the physiology of the vagus nerve in man and in animals makes the study of that nerve particularly difficult, since in basic principles the physiology studied in experimental animals varies greatly from that known in man.

The first recorded successful esophagoscopy was one in which the diagnosis of carcinoma was established by histologic examination of removed tissue. Progress in esophagology can well be measured by the history of this disease entity. Palliation obtained through use of antispasmodic drugs, dilations, gastrostomy and supplemental intravenous and other feedings has given way to internal and external irradiation and surgical resection. The complete cure of a patient with carcinoma of the esophagus, unknown as recently as ten years ago, excluding one or two brilliant exceptions, is now the goal of every esophagoscopist

and thoracic surgeon working as a team in this specialty. Even in these few years the surgical indications and technics have increased and improved rapidly. Originally, resections were followed by years of plastic procedures designed to reconstruct the food passage subcutaneously. Now the stomach is freed, brought high in the thorax and anastomosed directly to the cervical portion of the esophagus if necessary. Resection of the cervical portion of the esophagus itself, if esophageal carcinoma is localized in this segment, is also feasible in an increasing number of cases as technics develop for this heretofore hopeless condition.

Advances in the technics and equipment for irradiation have also resulted in an increasing number of cures of carcinoma of the esophagus. The deep, inaccessible position of the esophagus means irradiation of many normal structures to reach the tumor, except when the neoplasm is in the cervical portion of the esophagus. Consequently, until recently such irradiation was not successful. The reports given in the Section on Laryngology, Otology and Rhinology last year indicate that real progress has been made. This is apparently true not only in cases of the squamous cell lesions of the cervical portion of the esophagus but also in some cases of adenocarcinoma of the distal extension of the esophagus. This phase of treatment bears further investigation and confirmation, and as technics improve undoubtedly other series will be added.

Advances in all fields of medicine and surgery have made possible the extensive procedures described in the foregoing pages. Anesthesiology is one field which has influenced esophagology not only by making the external esophageal surgical procedure possible but by permitting certain esophagoscopic procedures to be performed with added safety. Intratracheal anesthesia provides an adequate airway and is of immeasurable assistance in some instances. Curare aids in that it produces relaxation sufficient for some unusually difficult endoscopic procedures; this represents distinct progress.

Chemotherapy likewise has changed well established therapeutic principles in the management of diseases of the esophagus. This is particularly true in the management of periesophagitis, esophageal lacerations and perforations of the esophagus. It is still unquestionably true that in the case of a localized mediastinal abscess which has followed esophageal perforation prompt surgical drainage is imperative. Such drainage is also indicated in low or even more extensive high infections. But the immediate surgical exposure of the mediastinum for prophylactic purposes in suspected cases of high esophageal perforation as well as for drainage in known cases of early esophageal perforation may now be questioned. In many cases it may be avoided by prompt, adequate, well controlled administration of penicillin, sulfonamide compounds, streptomycin and arsenical preparations. The overwhelming sepsis so

often a cause of death twelve to twenty-four hours after an esophageal perforation may now, in many instances, be adequately controlled. Repeated studies of the course of the disease are essential, with mediastinotomy indicated if findings increase. Such studies consist of a temperature reading every four hours, a white blood cell count every twelve hours and a daily roentgen study of the neck. The symptom complex is no criterion of the stage of the disease process once chemotherapy has been instituted, because a mediastinal abscess may develop steadily without symptoms in spite of adequate chemotherapy. In cases of perforation of the distal part of the esophagus, the advances in thoracic surgery have greatly increased the number of recoveries. Such perforations are the result of action of foreign bodies, instrumentation, chemical trauma or cancerous growth. Recently several perforations have been recorded as following poliomyelitis, possibly due to esophagitis caused by the regurgitation of gastric secretion. In the perforations of the distal part of the esophagus due to presence of foreign bodies or to instrumentation, prompt surgical drainage of the pleural cavity or of the posterior mediastinum, in conjunction with chemotherapy, is indicated.

The concept of the esophagus as a simple muscular tube extending from the mouth to the stomach overlooks much of importance in esophagology. Motion pictures taken through the esophagoscope show the active movement of the esophagus as the contraction wave precedes the advancing tube, and also the passive movements associated with respiration and the cardiac impulse. The symptoms of organic esophageal disease are primarily those of obstruction; dysphagia, pain on swallowing, inability to swallow, and the regurgitation and discomfort associated with esophageal retention of food and fluid. One of the symptoms, so commonly described in the absence of organic disease that it has become a by-word for a functional disorder, is "lump in the throat." This symptom, easily ascribed to globus hystericus, may indeed be due to organic disease localized in the esophagus. It may be the reflection of some acute or chronic systemic disorder, such as anemia, achlorhydria or a chronic debilitating disease. On the other hand, the psychosomatic aspects of esophageal symptoms are important enough to require expert consultation and treatment after any organic cause of the symptoms has been sufficiently eliminated by proper physical, roentgen and esophagoscopic studies.

700 North Michigan Avenue.

ABSTRACT OF DISCUSSION

DR. FLETCHER D. WOODWARD, Charlottesville, Va.: For many years the study of the function and of the diseases of the esophagus was the most neglected subject in medicine. It was a sort of "no man's land," shunned by all, even though their fields of practice were intimately associated with its function.

This neglect was no doubt due to the inaccessibility of the esophagus and to the lack of means for its examination and for the treatment of its numerous disorders. Even today, in spite of the tremendous advances made in diagnosis and treatment, evidence of the neglect of the esophagus is all too frequent. To combat this lack of interest, more space should be allotted to its diseases in textbooks, more emphasis should be placed on it in undergraduate teaching, and discussion of the problems relating to it should appear more frequently in the programs of medical meetings. By these means, the cardinal symptom, dysphagia, will be made significant enough to warrant prompt investigation.

As a result of the interest and the ingenuity of a relatively small number of physicians, numerous instruments have been devised for the examination and the treatment of the esophagus. These instruments, in conjunction with advances in roentgenography, thoracic surgery and drug therapy, have today advanced the knowledge of this field to the point where it has earned the right and dignity of being termed esophagology.

Dr. Holinger has ably given a review of the progress and present status of esophagology, and although one may view past accomplishments with pride, there is still much work to be done in physiology and pathology, especially in regard to the functional disorders, such as achalasia (cardiospasm), and in the treatment of carcinoma. One must also seek every opportunity to bring before the medical profession the importance of the diseases of the esophagus, the value of the symptom of dysphagia, the ability to make a diagnosis by roentgenography and esophagoscopy and finally the present status of treatment. By these means will the science of esophagology be rapidly advanced.

DR. E. G. GILL, Roanoke, Va.: I enjoyed Dr. Holinger's paper and congratulate him on his beautiful presentation.

I have observed 2 cases of congenital absence of the esophagus. In each instance the diagnosis was confirmed at autopsy.

I should like to ask the essayist or some of the discussers whether they will say something about the value of extracting foreign bodies from the esophagus and air passages with the aid of the electric magnet.

DR. PAUL H. HOLINGER, Chicago: I should like to thank Dr. Woodward and Dr. Gill for their discussions. I am afraid that I should be at just as much of a loss as Dr. Gill was in regard to the management of a patient without an esophagus. The surgeon has now carried the stomach up to the hypopharynx, practically, in reestablishing a passage, following an esophagectomy for carcinoma of the esophagus. Whether or not that procedure would be feasible in congenital absence of the esophagus would be difficult to determine. Possibly an external esophagotomy followed by a gastrostomy would be the only opportunity that the patient might have. Attempts to reestablish the food passages later would certainly be difficult.

In regard to the electromagnet in the removal of foreign bodies from the esophagus, we feel that in most instances the forceps applied under direct vision is more satisfactory than the magnet, unless the foreign body lies loose in the stomach; in that case we should prefer to use the magnet if the foreign body is known to be a metal readily held by a magnet. In this regard Dr. Equen is going to present an interesting patient at the end of this session, and he will discuss the problem of the foreign body that lies beyond the stomach.

THE OTOLARYNGOLOGIC CONSULTANT IN COMPENSATION AND LIABILITY ACTIONS

C. STEWART NASH, M.D.
ROCHESTER, N. Y.

AS A YOUNG GIRL came into the grocery store, a clerk gave her a "playful twirk" of the nose. Some time later on, when a septal abscess and a saddle nose developed, her father sued the groceryman for $4,000 damages.

In the preparation of this case, the attorney for the defense uncovered an important bit of evidence. It appears that three days after the "playful twirk" of the nose the mother had struck the child "a violent blow" across the face, after which the nose swelled, the septal abscess developed, and the deformity occurred.

Two consulting otolaryngologists, testifying for the defense, were asked the same hypothetic question: "If (on a certain date) the child received a 'playful twirk' of the nose and three days later sustained a 'violent blow' across the face, which of these injuries in your opinion most probably would have produced the septal abscess and the subsequent nasal deformity?" Both consultants stated that in their judgment the mother's blow was probably the causative factor in the production of the saddle nose.

The cross-examining attorney, realizing the unfavorable effect of the defense's discovery, attempted, by means of questions not entirely irrelevant, to discredit both the doctors and their testimony.

The attorney for the plaintiff said, "Doctor, injuries to the nose are painful, aren't they?"

The physician replied "Sometimes they are."

"Do you mean to tell me, Doctor, that nasal injuries may *not* be painful?" continued the plaintiff's attorney.

"Yes," answered the consultant.

Immediately the cross-examiner reached for a large red book, which he held before the court and from which he read a sentence purporting to state that injuries to the nose were painful.

Read before the Southern Section of the American Laryngological, Rhinological and Otological Society, Inc., at Miami Beach, Fla., Jan. 6, 1947.

"Doctor," shouted the plaintiff's attorney, "Dr. Deaver wrote that book and Dr. Deaver is one of the greatest nose surgeons in the country, isn't he?"

The consultant retorted, "Not so far as I know. I thought he was a general surgeon."

"That's all," was the reply. "You're dismissed."

Goings-on of this sort used to be typical of medical testimony in court. Fortunately, the medical consultant in this case was better informed than the examining lawyer, but such court procedures are still in practice, and the boast that lawyers can make monkeys of doctors in court can be deflated only when medical consultants take their work seriously and develop a proficiency that the legal profession respects.

Primarily a good otolaryngologic consultant in compensation and liability actions must be a good otolaryngologist, and as such he must be expert in compiling and correlating histories and medical data. Recognizing the importance of chief complaints, he must be able to make a comprehensive and chronologically tabulated account of exactly what the claimant asserts led up to the cause of the action.

Such a tabulation should start in this manner:

He stated:

(1) that on Jan. 6, 1947, he was employed by.....as a welder;

(2) that on that date, at 2 p.m., he was struck on the head by a lever . . . etc.

When the history is complete, the consultant then asks questions concerning points not adequately covered by the patient's story and also concerning items involving causal relation. The answers to such questions are tabulated as follows:

The claimant said:

(1) that he was not unconscious at any time;

(2) that the ears did not bleed;

(3) that he never had any difficulty (. . .) before the date of injury . . . etc.

As these questions are asked, the consultant proceeds to the examination proper. Never should he consider either the examination or its preliminaries as elementary or of casual importance. To examine the whole of the basic field of otolaryngology and to do it knowingly and painstakingly is most important. Regardless of the site of injury, the ears, the nose, the mouth, the pharynx, the larynx and the sinuses are all inspected.

I impress on those who may be called into court as consultants the importance of making positive statements about normal findings. For

example, one should record that the drum heads and the external canals are normal. One should not say that they are negative, for the word "negative" has undergone peculiar distortions on cross examination. Similarly, in considering the external nose, one should say that the nose is in alinement anteriorly and in profile, not that it is negative in appearance.

Abnormalities observed in the basic field, even though apparently unrelated to the complaints, require accurate and detailed descriptions.

With this basic examination concluded, special attention is given to specific symptoms and the anatomic parts to which they refer. Such an examination may include acoustic and vestibular studies, endoscopy, roentgen examinations—to name but a few.

As the basic and special examinations come to an end, the consultant reviews the history, the answers to questions interpreting the history, and the inconsistencies and improbabilities, all of which are transcribed in an abbreviated but intelligible form on the office record.

Although some consultants advocate that the official report be dictated immediately after completion of the review, I prefer a delay, for it assists me in maintaining better objectivity in evaluating facts and allegations.

Since the report of the otolaryngologic consultant is potential testimony, it must be accurate in every detail. The historical tabulation must be presented exactly as given by the claimant; the answers to questions on the history must conform precisely to the claimant's replies; and the notes on inconsistencies and improbabilities must be thoroughly objective. The consultant must never try to prove a point or to defend a hypothesis.

If possible, the report should contain a definite diagnosis or diagnoses, if impossible, the diagnosis may be referred to as "possible," "probable" or "undetermined."

A particularly significant part of the report is the discussion—preferably tabulated—which includes a summation and a study of causal relation. Here one finds a section on conceded points, one on disputed points, one on inconsistencies and improbabilities, and lastly one on questions that may arise on cross examination.

The conclusion of the report is a concise statement concerning the complaints in terms of causal relation. A prognosis or a probable prognosis ends the account.

Obviously, an otolaryngologist can be no smarter as a consultant than he is as a practitioner, and well may he ask, "How can I be a keen otolaryngologic consultant in compensation and liability actions?"

In general, I should answer the question as follows:

An ear, nose and throat specialist can be an expert legal consultant

1. When he is willing to spend unlimited amounts of time and energy in the preparation of a report. (Cases of malingering in particular require repeated examinations and repeated rough drafts.)

2. When he becomes thoroughly painstaking, learns to make a minimum of mistakes and never for a moment loses his sense of objectivity. (Some doctors have feelings for or against a claimant; others make statements that they cannot prove. If, for example, a physician testifies that the plaintiff had a concussion of the brain, he must be ready to explain what a concussion of the brain is and why he is justified in calling the injury in question a concussion of the brain.)

3. When he knows the art of reasoning and is technically logical. (Undoubtedly an expert with training in logic has the edge on one who has had no such training.)

4. When he can present a case clearly, concisely, and in a manner easy to understand. (In dictating a report which, as I have inferred, is testimony in the making, he must express his findings and ideas in phrases adapted to the understanding of adjusters, referees, lawyers, judges and juries. Since the experienced and thorough legal otolaryngologic consultant is bound to know more about the medical aspect of an action and probably more about the causal relation than any one else, he can well afford to be confident but modest, and in an unassuming way he can relate the facts in the objective manner in which he views them.)

5. When he is able to define issues and to present all evidence pro and con.

6. When, as a witness, he has learned never to argue and never to offer information not specifically asked.

7. When he has had years of experience in compensation and liability actions.

8. And when he is thoroughly honest in every way.

Frankly, in compensation and liability actions the whole job of an otolaryngologic consultant is to ferret out the truth or the truth so far as it can be established. It is never his job to get evidence for or against any one. He must never be swayed or influenced by such factors as the interests of those employing him or the fee, which may be large or small, depending on the manner in which he testifies.

To repeat, then, the whole purpose of the otolaryngologic consultant is to discover the truth as it unfolds itself in a certain action. That such is the purpose of the consultant is admitted by all, and all give that purpose lip service, but in spite of these declarations the fact remains that truth, noble as it may be, is not always a marketable commodity.

For many years I have threatened to limit my work as an otolaryngologic consultant, at least in liability cases, entirely to the interests of the defense. In my experience the defense—that is, the insurance carriers—honestly want to know the truth about an action and are willing to assume reasonable responsibility for the obligations that the truth involves.

The plaintiff, on the other hand, can use the truth only if it is beneficial to him; in most actions truth unfavorable to the plaintiff has no marketable value. Not only does the plaintiff hesitate to pay his consultant for unfavorable truth, but even when the truth is favorable he expects to put the consultation service on a contingent basis—that is, on the "you get paid if we get paid" footing—and often he insists on making the consultation fee as high as possible for the purpose of increasing the amount of the damages, and then, when the settlement comes, he either wants a rebate or does not pay the consultant at all.

Perhaps times are changing, for it is my observation that more and more opposing attorneys in compensation and liability actions are coming into my office to clarify and define issues before trials actually begin.

Recently a man with a long-standing bilateral hearing loss became involved in an accident in which he allegedly received an aggravation of the loss in the left ear. My studies indicated that the claimant had approximate losses for speech of 52 per cent in the left ear and 41 per cent in the right ear. The difference in losses between the two ears, or 11 per cent, might have been either a preexisting nontraumatic deafness or a superimposed traumatic deafness.

Since this point did not lend itself to an exact decision, the assumption had to be maintained that the 11 per cent loss could have been traumatic in origin. The defense admitted this possibility and also accepted as correct the assertion that a traumatic loss of 11 per cent superimposed on a preexisting loss of 41 per cent was more serious to the claimant than an 11 per cent loss in an ear with normal hearing or in an ear with only a minor disability.

All this clarification was made in a meeting of opposing attorneys in my office. Now a trial is going to take place anyway, but only one issue remains. Briefly it is this: Is an 11 per cent traumatic hearing loss in one ear superimposed on a 41 per cent nontraumatic loss in the same ear worth $6,000 as the claimant maintains or $1,500 as the defense asserts?

Of course, a plaintiff whose case is weak and whose attorney does not wish to admit the weakness will object to such a clarification procedure.

In my concluding remarks I should like to admonish the prospective otolaryngologic consultant with these words of a champion checker player. He said, "To be a champion one must know the game, but, in addition, one must realize that there is a right move for every position. The expert knows the positions and the right moves, and so long as he never makes a mistake he can never lose. In the event of two experts meeting and making no mistakes, the outcome is always a draw."

277 Alexander Street.

MANAGEMENT OF ESOPHAGEAL STRICTURES

CLAUDE C. CODY III, M.D.
HOUSTON, TEXAS

THE PURPOSE of this paper is to present a technic for the management of extensive cicatricial stenosis of the esophagus. This technic has been employed in the University Hospital at Ann Arbor, Mich., during the last four years, with satisfying results. The prime objective of treatment is, of course, to relieve the patient of his symptoms and to establish an adequate esophageal lumen. A minimal period of hospitalization is possible when the patient is trained to carry out his own dilation. This not only helps to lessen the morbidity but also is a powerful boost to the patient's mental outlook.

Unfortunately, most of the patients with stricture of the esophagus present themselves when their condition is of long standing. Some are unable to swallow even their saliva, and all are in a state of malnutrition. The management of acute chemical burns of the esophagus [1] has been effective when it included early and repeated bougienage, soft rubber bougies that are filled with mercury (Hurst) or lead shot (Bokay) being used. In cases of the acute type dilation may, and in fact definitely, should be commenced on the third day after the burn and gently repeated daily for three or four weeks. Such therapy when carefully carried out will usually prevent subsequent stenosis. Gellis and Holt [2] showed very strikingly that good results could be obtained by early dilation of esophageal burns.

The patient with esophageal stenosis due to scar formation is first treated for dehydration with dextrose, intravenously injected, and vitamin supplements. This may take several days, during which time fluoroscopic examination of the esophagus is performed, thin liquid barium sulfate being used or (in the case of infants) iodized poppyseed oil 4 per cent. Next, the patient is given an initial esophagoscopic examination to determine the tightness of the stricture. Under direct vision, a small bougie is used to detect the presence of any possible false pockets

---

From the Department of Otolaryngology, University Hospital, Ann Arbor, Mich.

Read before the American Federation of Clinical Research, Southern Section, Dec. 14, 1946.

1. Crowe, J. T.: Poisoning Due to Lye, Am. J. Dis. Child. **63**:9-12 (Jan.) 1944.

2. Gellis, S. S., and Holt, L. E., Jr.: Treatment of Lye Ingestion by the Salzer Method, Ann. Otol., Rhin. & Laryng. **51**:1086-1088, 1942.

or pouches. It is also important to note whether any reaction persists about the scar in the form of granulations or a pseudomembranous deposit. Vigorous dilation should not be done if there is an acute reaction about the stricture.

It is rare that gastrostomy can be avoided in cases of advanced esophageal stricture.[3] Only when the scar is quite short and dilates readily, allowing subsequent treatments to be accomplished by the swallowing of a mercury-filled bougie (Hurst dilator), can gastrostomy be avoided. Frequently, the smallest dilator will not pass from above through the stricture into the stomach. Gastrostomy is then performed to initiate retrograde esophageal dilation.[4] Actually this procedure shortens hospitalization, as the patient can be discharged to return as an outpatient for the necessary retrograde dilations.

A few words concerning the necessary teamwork between surgeon and endoscopist at the time of the gastrostomy seem pertinent. When the gastrostomy wound is open, a small dilator is passed from above into the stomach, if possible. A string is attached to the lower end of the dilator, and the dilator is then withdrawn through the mouth, leaving the string in the esophageal lumen. This string can be used subsequently in drawing dilators through the stricture in a retrograde fashion.

As sometimes happens, however, dilators cannot be passed through the stricture from above into the stomach. This problem may be coped with by employing the following technic:

Two weeks are allowed for the gastrostomy wound to heal thoroughly. A panendoscope is passed through the gastrostomy opening into the stomach. Distention of the stomach with isotonic solution of sodium chloride greatly aids in visualizing the opening of the cardiac end of the esophagus. This opening is catheterized in a retrograde fashion with a small ureteral catheter. In my hands, this procedure has been successful even when barium sulfate and the smallest dilator could not be admitted through the stricture from above. Experience has shown that the esophageal stricture is never so tight at the lower end of the stricture as at the proximal end, since most of the effect of the chemical burn is at the region where the substance initially made contact with the esophageal well. It is certainly true that catheterization of the esophagus from below is sometimes quite easy when dilation from above is impossible. When the ureteral catheter has been passed through the stricture from below, the endoscopist grasps the catheter through a short esophagoscope from above. The catheter is then brought out through the mouth, care being taken to have a string securely attached to the lower end of the catheter. Once a string has been passed through the stricture, dilation (retrograde) can usually be employed without difficulty.

Periodic retrograde esophageal dilation with the Tucker filiform bougies can be done as an outpatient procedure. The gastrostomy wound can be kept closed and all feedings taken by mouth. When dilations have reached a caliber of French no. 36 to French no. 40, Hurst dilations can be started. The Hurst dilators are

---

3. Adams, R., and Hoover, W. B.: Corrosive Stricture of the Esophagus, with Function Restored by Combining Surgical and Endoscopic Treatment: Report of Case, Lahey Clin. Bull. **3**:250-255, 1944. Turner, G. G.: Fibrous Stricture of Gullet of Nineteen Years' Duration: Feeding by Extrathoracic Rubber Esophagus Throughout Greater Part of That Time, Brit. J. Surg. **30**:344-353, 1943.

4. Lederer, F.: Diseases of Ear, Nose and Throat, Philadelphia, F. A. Davis Company, 1942, pp. 770-776.

easy to swallow, and the patient can readily be taught to perform the dilation himself. He is asked to purchase one of the Hurst dilators, of a size that he has successfully passed, and instructed to use it at intervals, or when symptoms of dysphagia develop. Such a plan of therapy has proved effective and eliminates many of the inconveniences of the older direct method of dilation in which rigid dilators were used.

During the last four years 14 patients with esophageal stenosis have been treated at the University of Michigan Hospital. The data concerning these patients are presented in the accompanying table.

From this table it may be noted that every patient except one has had a satisfactory response. It may be said, as a general statement, that if a Hurst dilator of a French no. 26 caliber or greater can be passed, therapy is adequate. Even the esophagus of patient 2, which still requires retrograde dilation via the gastrostomy route, can be dilated with difficulty only to a French no. 26 caliber dilator, and yet the patient can eat soft foods without excessive difficulty. This particular patient returns so infrequently and cooperates so poorly that proper dilation cannot be maintained. It has been found that retrograde bougienage must attain a no. 30 or no. 32 French caliber dilator before Hurst dilation can be started, and it is desirable to have the retrograde bougienages reach a no. 40 French for the best results.

Patients 5 and 7 showed good results with French no. 40 caliber dilator via the retrograde route, but because of their youth they have not learned to cooperate sufficiently to use the Hurst dilators successfully. In 1 patient (3) the flexible tip Jackson bougie has been passed by blind bougienage in the outpatient department, although the Hurst dilator can also be passed. In the latter case, there is considerable dilation above the stricture, and the Hurst dilator tends to double up before going through the stricture.

In this series, 1 patient acquired an empyema of the chest, which required drainage. This was due to overenthusiastic attempts at dilation from above before gastrostomy was employed. Two of the patients have had foreign bodies extracted from the esophagus during the course of dilation. There have been no deaths, and all patients have been able to gain weight. The adults have been able to carry on gainful occupations, and it has been especially gratifying to note the marked improvement in the mental outlook of the adults as dilation progressed. Psychotherapy and reassurance are much needed by these patients. Once the patient learns to use a Hurst dilator in self dilation of the esophagus, and the gastrostomy wound is permanently closed, he may be discharged as cured.

Summary of Data on Fourteen Cases of Esophageal Stricture in Which the Technic Described was Used

Patient	Cause	Site of Stricture	Age	Interval Before Seen	First Seen	Last Seen	Type of Therapy	Condition When Last Seen
1. W. D. H.	Lye	Upper ⅓	28	4 months	Aug. 1943	1/10/45	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst F. no. 36; good
2. L. Y.	Lye	Upper ⅓	21	2 months	Sept. 1937	6/27/45	Gastrostomy and retrograde bougienage	Retro. to F. no. 26; poor
3. W. S.	Plumbite	Middle ⅓	3	5 weeks	Nov. 1940	9/11/46	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 28; good
4. D. R.	Congenital (?)	Middle ⅓	15	Since birth, increasing	Aug. 1938	7/ 8/44	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no 30; good
5. G. V.	Lye	Middel ⅓	5	6 weeks	Feb. 1945	11/30/45	Gastrostomy and retrograde bougienage	Retro. to F. no. 40; good
6. E. W.	Lye	Middle ⅓	2	2 months	June 1944	12/ 3/45	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 40; good
7. B. A.	Lye	Middle ⅓	4	5 weeks	April 1945	11/24/46	Gastrostomy and retrograde bougienage; drainage of empyema	Retro. to F. no. 40; good
8. L. LeP.	Ammonia	Middle ⅓	51	3 months	July 1945	12/29/45	Gastrostomy, retrograde bougienage and Jackson	Jackson F. no. 30; good
9. R. S.	Scarlet fever (?)	Upper ⅓	51	22 years, increasing	Jan. 1942	9/ 7/43	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 40; good
10. M. L.	Drano	Middle ⅓	19	2 months	June 1944	12/20/45	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 34; good
11. J. S.	Hydrochloric acid	Lower ⅓	58	2 weeks	Jan. 1943	6/ 2/43	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 26; good
12. P. P.	Unknown	Lower ⅓	74	5 years, intermittent	Sept. 1944	1/ 2/46	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 40; good
13. A. T.	Lye	Middle ⅓	18 mo.	1 month	May 1942	9/18/45	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 28; good
14. T. T.	Acid	Middle ⅓	38	1 month	Jan. 1943	8/30/43	Gastrostomy, retrograde bougienage and Hurst mercury-filled rubber bougies	Hurst to F. no. 30; good

SUMMARY

A method of managing long-standing strictures of the esophagus is presented. It has proved successful in the cases seen in University Hospital at Ann Arbor, Mich., during the last four years. The ultimate objective is to have the patient symptom free and able to pass his own dilators as the occasion demands. The method is safe. Even children can be taught to pass their dilators, in time. The patient who can pass a Hurst dilator of French no. 26 caliber or greater will probably experience no dysphagia in eating all kinds of food.

It is important with adults as well as with children to employ encouragement and reassurance, every effort being made to help solve the various conflicts that may exist in their environment. Doing away with gastrostomy wounds early and allowing the patient to treat himself is a strong boost to his stability and reassurance.

Once the smallest string can be passed from the mouth to the stomach, the prognosis is good.

1304 Walker Avenue.

PENICILLIN AND STREPTOMYCIN AEROSOL IN THE TREATMENT OF PULMONARY DISEASE

E. W. HAGENS, M.D.

MARY KARP, M.D.

AND

C. J. FARMER, M.A.

CHICAGO

IN MAY 1945 we [1] reported our preliminary experience with penicillin inhalation therapy. The results obtained in 22 cases of pulmonary disease were given, and conclusions were reached that while penicillin aerosol was helpful against bronchiectasis, another antibiotic was necessary to eliminate the gram-negative, penicillin-resistant bacteria. We had tried streptomycin aerosol in case 8 of our preliminary report, with encouraging results, but we did not mention the name of the antibiotic as the manufacturer asked that it be withheld, fearing too great a demand for the substance at that time. The present report concerns a series of 10 patients treated with both penicillin and streptomycin. In addition, the results of the use of penicillin inhalations as observed in 111 patients encountered by the department of anesthesia in the routine management of inhalation therapy are given. The question of blood levels is also considered.

The equipment used has been the same as previously reported: an O.E.M. mask (oronasal),[1a] without the vvalve (this permits rebreathing); a DeVilbiss no. 40 nebulizer, and an oxygen tank. Relying on the reports of others, we have tried various technics, but for our purposes we have found the original method the most suitable.

Read at the joint meeting of the Chicago Laryngological and Otological Society and the Middle Section of the American Laryngological, Rhinological and Otological Society, Chicago, Jan. 20, 1947.

From the Department of Otolaryngology, Wesley Memorial Hospital, and Northwestern University Medical School (Dr. Hagens); Department of Anesthesia, Wesley Memorial Hospital, and Department of Surgery, Northwestern University Medical School (Dr. Karp); Department of Biochemistry, Northwestern University Medical School (Professor Farmer).

1. Hagens, E. W.; Karp, M., and Farmer, C. J.: Inhalation Method for Penicillin Therapy, Arch. Otolaryng. **41**:333 (May) 1945.

1a. This mask is marketed by the Oxygen Equipment Manufacturing Company.

REPORT OF RESULTS

Ten patients, 5 males and 5 females, have been treated since July 1945. The age variation was from 11 to 56 years. Table 1 shows the pathologic conditions for which these patients were treated.

Table 2 shows the number of initial specimens of sputum in which the various bacteria occurred, as demonstrated on culture.

TABLE 1.—*Pathologic Conditions Diagnosed Clinically in Ten Patients Treated with Both Penicillin and Streptomycin Aerosols*

	Patients
Bronchiectasis	4
Chronic bronchitis	2
Bronchial asthma (bacterial factor probable)	4

TABLE 2.—*Bacteriologic Findings in Initial Specimens of Sputum, Taken Before Treatment*

Streptococcus nonhaemolyticus	2
Streptococcus viridans	8
Diplococcus pneumoniae	3
Staphylococcus albus	8
Staphylococcus aureus	5
Neisseria catarrhalis	7
Proteus vulgaris	1
Hemophilus influenzae	1
Gram-negative rods	2

TABLE 3.—*Bacteriologic Findings in Specimens of Sputum, Taken Three to Twenty Days After Treatment*

After Inhalation of Penicillin	After Inhalation of Penicillin and Streptomycin
P. vulgaris (only)	No growth
P. vulgaris (only)	Yeast cells
P. vulgaris (only)	Yeast cells
P. vulgaris (only)	P. vulgaris
P. vulgaris, yeast cells	Yeast cells
P. vulgaris, N. catarrhalis	P. vulgaris
Aerobacter aerogenes, Pseudomonas aeruginosa	A. aerogenes, Ps. aeruginosa
A. aerogenes	A. aerogenes, D. pneumoniae
Ps. aeruginosa	No growth
Str. viridans, N. catarrhalis, Staph. albus, Micrococcus tetragenus	A. aerogenes, Str. viridans

Table 3 reveals the bacteria found on culture of specimens of sputum taken three to twenty days after treatment was started.

As can be seen from table 1, the diseases for which patients were treated included mainly bronchiectasis, chronic bronchitis and asthma; the last probably included a bacterial factor. Penicillin solution, nebulized and inhaled, caused the gram-positive bacteria to disappear after several days in 8 of the 10 cases (tables 3 and 4). After inhalations of streptomycin aerosol had been added, the gram-negative bacteria, also, disappeared in 5 cases (4, 6, 7, 8 and 10), but yeast cells were found in 3 of these cases (6, 7 and 8). In the 5 remaining cases (1, 2, 3, 5

and 9) bacteria, predominately gram-negative, persisted throughout the treatment. The difference of the results seems to be explained by the fact that 500,000 units of streptomycin was aerosolized per day for the group that became free of bacteria, while for the other patients only 200,000 units was nebulized. In case 3 the penicillin therapy was stopped for a day or so when the use of streptomycin was begun. It was noted that the gram-positive bacteria recurred in the sputum, so that it was necessary to give the patient both antibiotics in order to keep the sputum free of bacteria. Approximately 200,000 units of penicillin per day appears to be sufficient to cause the disappearance of the gram-positive bacteria.

As previously reported, 16 inhalation periods are given each twenty-four hours, night treatments being given at 1 and 4 a.m. When both antibiotics are given, they may be mixed, 200,000 units of penicillin sodium and 500,000 units of streptomycin, in the 25 cc. of diluent (isotonic solution of sodium chloride or distilled water). When penicillin calcium is used, however, small precipitate particles clog the nebulizer, so that it is necessary to have a separate nebulizer for each antibiotic. Some patients require seven minutes to aerosolize the 1.5 cc. of the solution, although five minutes has been the average time. The concentrations of the drugs and the rate of oxygen flow (average, 7 liters per minute) can be varied as necessary to insure inhalation of the required amount each 24 hours.

In order to determine whether absence of cultural growth might not be due to the action of penicillin present in the sputum, penicillinase was added to the specimens in case 8; 1 cc., or 100 units, of penicillinase was added to 10 cc. of several specimens of sputum, and on other occasions, to the blood agar medium. Cultures supplemented with penicillinase were reported as showing "no growth" (free of bacteria) just as were the ones without it. In case 9, in which Proteus vulgaris was found in the sputum, the addition of penicillinase did not alter the findings. A penicillin level was obtained in the sputum in cases 1, 2, 4 and 5. In sputum expectorated one-half hour after treatment the penicillin level varied from 1 to 64 units per cubic centimeter, many specimens showing 4 to 8 units per cubic centimeter.

Definite blood levels of penicillin (table 4) were found only in cases 8 and 9 on samples taken one-half hour after an inhalation treatment. In case 8, the patient, after being treated by nebulization of 1 cc. of a solution containing 16,000 units of penicillin per cubic centimeter for five minutes, had a blood level of 0.015 unit per cubic centimeter of serum. A level of 0.25 unit was found in this same patient after nebulization of 1 cc. of a solution containing 75,000 units of penicillin per cubic centimeter. A second patient (case 9) revealed a blood level of 0.125 unit after five minutes' nebulization of 1 cc. of a solution containing 67,500 units of penicillin. Another patient (case 5) showed no blood levels on the usual inhalation therapy, with 8,000 units per cubic centimeter, but when, in addition, oral penicillin tablets, 50,000 units each, were taken at the rate of 8 per day, the blood level in one day reached 0.12 unit per cubic centimeter of serum and, on the next day, 0.48 and 0.24 unit in the morning and afternoon, respectively. Table 5 gives the results obtained on a normal volunteer, (K) who inhaled nebulized solutions containing various amounts of penicillin per cubic centimeter. The figures show that a blood level was not obtained until a solution containing more than 50,000 units per cubic centimeter was inhaled. Some irritation of the throat was noted with these higher concentrations, although the inhalations were completed. The table also shows the loss of penicillin as recovered from the rebreathing bag.

TABLE 4.—*Summary of Data on Patients Treated with Penicillin and Streptomycin Aerosol*

Case	Age, Yr.	Clinical Diagnosis	Micro-Organisms Isolated on Culture of Sputum			Penicillin			Streptomycin		Results of Treatment
			Before Treatment	After Inhalation of Penicillin	After Inhalation of Penicillin and Streptomycin	Duration of Treatment, Days	Serum Level 30 Min. After Treatment, Units per Cc.	Urinary Level in Random Sample, Units per Cc.	Duration of Treatment, Days	Blood Level 30 Min. After Treatment, Units per Cc.	
1. Mr. S.	56	Chronic bronchitis, bronchial asthma	Str. nonhaemolyticus N. catarrhalis Staph. albus D. pneumoniae	A. aerogenes Ps. aeruginosa	A. aerogenes Ps. aeruginosa	18	0	4 to 30	6	..	Some improvement
2. Travis	11	Bronchiectasis	Str. viridans Staph. albus Staph. aureus N. catarrhalis	Str. viridans N. catarrhalis Staph. albus M. tetragenus	A. aerogenes Str. viridans (few colonies)	20	0	0.5 to 32	19	0	Improvement
3. Mrs. G.	49	Chronic bronchitis	Str. viridans Staph. albus N. catarrhalis Staph. aureus Str. nonhaemolyticus H. influenzae	A. aerogenes	A. aerogenes D. pneumoniae Yeast cells	3	..	..	4	..	No definite improvement
4. Mrs. R.	32	Bronchial asthma, probable bacterial allergy	Str. viridans D. pneumoniae N. catarrhalis Gm.-neg. rods Staph. aureus After 2d treatment given 3 mo. later:	Ps. aeruginosa	.....	16	0	2 to 128	..	..	Temporary improvement of asthma. Three months later patient was worse and reentered hospital

			Str. viridans Staph. albus Staph. aureus D. pneumoniae	.....	No growth	4	..	..	2	..	Improvement. Patient discharged
5. Mrs. N.	30	Asthmatic bronchitis (bacterial factor)	Str. viridans Gm.-neg. rods	P. vulgaris N. catarrhalis	P. vulgaris	7 Penicillin tablets (50,000 units) orally, 8 tablets per 24 hours	0 With tablets also, 0.12 to 0.48	16 to 64	3	0	Slight improvement, asthmatic symptoms persisted
6. Mr. S. W.	50	Bronchial asthma, pneumonitis	Streptococcus Staphylococcus Gm.-pos. diplococci	P. vulgaris Yeast cells	Yeast cells	13	0	..	9	0	Improvement. Patient also given typhoid vaccine. Asthmatic symptoms continued
7. Ted	23	Bronchiectasis	Str. viridans Staph. albus P. vulgaris	P. vulgaris	Yeast cells	11	0	..	6	0	Improvement; less cough and secretion; no odor from secretion
8. Mrs. M.	36	Bronchiectasis	Str. viridans Staph. aureus Staph. albus D. pneumoniae N. catarrhalis	P. vulgaris	Yeast cells	10	0.015 on nebulization of 1 cc. (16,000 units) 0.25 on nebulization of 1 cc. (75,000 units)	8 512	5	0	Improvement; less cough and expectoration
9. Louis	35	Bronchiectasis	Str. viridans Staph. albus N. catarrhalis	P. vulgaris	P. vulgaris	10	0.125 on nebulization of 1 cc. (67,500 units)	256	5	0	Slight improvement. Patient became asthmatic after streptomycin was added
10. Miss F.	37	Chronic bronchitis, recurrent pleurisy	Str. viridans Staph. aureus Staph. albus N. catarrhalis	P. vulgaris	No growth	14	0	..	7	0	Improvement; much less cough and secretion

An attempt was made to record blood levels of streptomycin, but even with the patient (case 10) inhaling 750,000 units a day no level was obtained. This is in keeping with the experiences of others as reported in the literature.

In our previous study it was found impracticable to record penicillin levels for total twenty-four hour volumes of urine. The nurses often failed to record all the samples, and the urine was not always kept properly iced. Therefore, the present report gives only the number of units per cubic centimeter of a single random sample of urine taken thirty minutes after a treatment (table 4). It will be seen that the penicillin level varied from 0.5 to 128 units when 1.5 cc. of a solution containing 8,000 units per cubic centimeter was aerosolized in five to seven minutes (usual technic). When the patient was given a more concentrated solution, a greater amount was recovered in the urine. In case 8 the usual technic produced a level of 8 units per cubic centimeter, but on aerosolization of a solution containing 75,000 units of penicillin per cubic centimeter the urine was found to contain 512 units per cubic centimeter. In case 9 the urine was found to have 256 units per cubic centimeter on nebulization of 67,500 units of penicillin. In case 5 the urine showed 16 to 64 units with the usual technic and 128 units with

TABLE 5.—*Blood and Urinary Levels After Five Minutes' Inhalation of Nebulized Penicillin Aerosols of Various Concentrations (Subject K)*

Time of Inhalation	Penicillin Concentration, Units per Cc.	Volume of Solution in Nebulizer, Cc.		Volume Nebulized in 5 Min. Cc.	Units Lost in Bag and Mask	Dose, Units *	Blood Level, 30 Min. After Inhalation, Units per Cc.	Urinary Levels 55 Min. After Inhalation		
		Initial	Final					Volume of Urine, Cc.	Units per Cc.	Units Excreted
9-9:05 a.m.	25,000	2	1.2	0.8	2,560	17,440	0.0	90	2	180
10-10:05	50,000	2	0.9	1.1	5,120	49,880	0.0	50	8	400
11-11:05	75,000†	2	1.0	1.0	12,800	62,200	0.125	50	8	400
12-12:05 p.m.	100,000†	2	1.1	0.9	16,000	74,000	0.25	90	32	2,880

*These figures include an unknown amount lost through the exhaling valve.
† The subject noted irritation at these concentrations.

the addition of oral penicillin. Similarly, variable urinary levels of streptomycin were obtained. The variations were so great that we are not reporting on them in detail at the present time.

A reaction occurred only in case 9. The patient was treated in the first series without reaction, but this time, after the addition of streptomycin, an asthmatic type of condition developed. The treatments were continued to completion, however, although the patient, owing to his shallow breathing, was able to inhale only a part of the normal amount at each treatment, and this may account for the fact that P. vulgaris persisted in the sputum until the termination of treatment.

All of the patients except one (case 3) were treated with penicillin for several days, and then both penicillin and streptomycin were inhaled. Both antibiotics were given from three to nine days except in case 2, in which the treatment was prolonged for almost three weeks.

Of the 10 patients treated, 9 reported more or less improvement (table 4). One (case 3, chronic bronchitis) did not obtain relief. Another patient (case 7) was treated also in the first series. This patient had far advanced bronchiectasis; in the six months since treatment was stopped there has been no return of the foul odor that had persisted for some years, and the secretions are definitely less. In case 9, however, in which P. vulgaris persisted, the odor has remained, and the

quantity of the secretion has not diminished. Of the 4 patients (cases 1, 3, 4 and 5) having asthma, probably with a bacterial factor, 3 presented only a slight general improvement, with persistence of the allergic condition. The fourth patient (case 4) noted improvement in the first series of treatments but returned three months later. Improvement occurred again, and the patient felt quite well on leaving the hospital.

In following the patients after they left the hospital, we examined the sputum in cases 7 and 10 one week later. In case 7 moderate growths of Streptococcus viridans, P. vulgaris and yeast cells were found, while in case 10 a moderate growth of P. vulgaris and a few colonies of Str. viridans were reported. While this shows a return of some of the bacteria, yet the variety and the number are definitely reduced.

Three patients (cases 7, 8 and 9) were examined with the bronchoscope just before treatment began, and were examined again one week after leaving the hospital. The appearance of the mucosa of the trachea and the bronchi was not

TABLE 6.—*Clinical Diagnoses Made in One Hundred and Eleven Cases in Which Penicillin Inhalations Were Administered Alone, by the Department of Anesthesia*

Infection of the upper respiratory tract (symptoms of common cold)	26
Bronchiectasis	21
Sinusitis (acute in 9, chronic in 3)	12
Asthma (predominating)	9
Acute pharyngitis	11
Bronchitis (chronic in 6, acute in 2)	8
Postoperative following intrathoracic surgical procedure	5
Laryngitis (acute)	4
Pneumonia (virus, atypical)	5
Atelectasis (postoperative)	2
Emphysema	2
Pulmonary hemorrhage (cause unknown)	2
Rheumatoid arthritis	1
Nosebleed	1
Tracheitis and tracheobronchitis (acute)	2

markedly improved over that noted prior to treatment, although in cases 7 and 8 there was less secretion and odor. In case 9 no change was noted on endoscopic examination.

In considering the 111 cases in which penicillin inhalations alone were given, it was found that the results were fairly difficult to establish. The entire medical and surgical staff had access to aerosol therapy for their patients through the department of anesthesia. Consequently, the indications cited to that department are not necessarily representative of our own indications for aerosol therapy but, on the contrary, represent the use made of that service by the various members of the hospital staff. Table 6 shows the clinical diagnoses recorded in the 111 cases.

In some of these cases the results of treatment and of follow-up examinations were inadequately recorded, making an accurate evaluation somewhat difficult. In general, the results tended to be similar to those reported in the preliminary, smaller series.[1] All but 7 patients showed some degree of improvement, ranging from slight relief to apparent cure, the latter being found mainly in those who had acute localized infections of the upper respiratory tract. All bronchiectatic

patients showed a reduction of sputum to one-third to two-thirds the preinhalation amounts. The patients having bronchoscopic examinations shortly after treatment revealed less odor, less secretion and slightly less congestion. The patients with asthma and bronchiectasis showed less promising results than those with bronchiectasis uncomplicated by asthma. Several, however, had improvement of breathing and reduction of sputum. The 5 patients with pneumonia were improved, the temperature curves becoming normal within one to five days. These patients received other medication along with the aerosol therapy.

There were two deaths in the series. One patient succumbed following surgical treatment of bronchiectasis, and the other died of advanced tuberculosis of the lung with massive hemorrhage. The 2 patients with emphysema showed no improvement. Most of the patients with acute pharyngitis, laryngitis and tracheitis appeared to experience a clearing up of signs and symptoms within a few days of treatment.

Some of the patients with infections of the upper respiratory tract were ambulatory patients, members of the department of anesthesia and of the staff of the hospital. The number of treatments varied from five to twenty, depending on the convenience of breaking a working day for the inhalations. In spite of the brief course, most of these patients received relief and volunteered the information that their colds were shortened by the aerosol therapy. In the 2 cases of atelectasis this cleared up without secondary invaders. Conclusions regarding clinical results in the cases of sinusitis were considered questionable because of the inadequacy of the diagnostic procedures and of the follow-up in these cases. In several there seemed to be relief of symptoms after a course of therapy, but penicillin had also been given intramuscularly.

One hundred and eleven patients, 46 males and 65 females, had been treated with aerosolized penicillin since Sept. 1, 1945. The youngest patient was a child aged 2, with bronchopneumonia secondary to whooping cough. She showed marked improvement following eight days of therapy. The oldest patient was a 76 year old man, who was treated for bronchiectasis, with moderate relief of symptoms. In the entire series the duration of treatment ranged from one-half day to thirty-one days.

Reactions probably due to penicillin occurred in 6 cases. One patient showed temporary dizziness on inhaling the aerosol. In 2 patients dermatitis developed; one had a skin rash around the scrotum and the medial surface of the thigh; the other, a dermatitis on the buttocks, occurring after twelve days of therapy. Both cleared up soon after penicillin was discontinued. Three patients experienced dyspnea after several treatments, and one-half the number of units of penicillin was used in these for the next four to five treatments. The dyspnea cleared up, and the therapy was continued as planned, with no further evidence of reaction.

COMMENT

The presence of detectable blood levels of penicillin and streptomycin following aerosol therapy has been a matter of controversy. It is generally agreed that assayable amounts of streptomycin are not present in the blood.[2] Specimens of our patients' blood have never contained detectable amounts of streptomycin even when urinary

2. Keefer, C. S.; Blake, F. G.; Lockwood, J. S.; Long, P. H.; Marshall, E. K., Jr., and Wood, W. B., Jr.: Streptomycin in the Treatment of Infections: A Report of One Thousand Cases, J A. M. A. **132**:4 (Sept. 7) 1946.

values of 15 micrograms per cubic centimeter have been obtained. However, culture of the sputum of these patients indicated a therapeutic response.

The results of our determination of the blood levels following penicillin therapy are in general agreement with those of other investigators. The inhaling of nebulized penicillin solution of 8,000 units per cubic centimeter for five to seven minutes gives no detectable blood level. Aerosols of higher concentrations (greater than 50,000 units per cubic centimeter) used for the same period with our technic are absorbed sufficiently to give measurable blood levels.

There has been speculation as to the amount of penicillin received by the subject and the amount remaining in the apparatus with a rebreathing type of equipment such as that described by us. To ascertain this, a normal subject (K, table 5) received nebulized penicillin solutions of concentrations of 25,000 to 100,000 units per cubic centimeter. The solutions were given once an hour, and each was nebulized for a period of five minutes. A sample of urine was collected just prior to each treatment, and a sample of blood was taken thirty minutes after each treatment. From table 5 it will be noted that with concentrations less than 75,000 units of penicillin per cubic centimeter, no blood level was obtained, although appreciable amounts were excreted in the urine at this and at lower levels.

Two cubic centimeters of penicillin solution was placed in the bulb of the nebulizer for each treatment, and the volume remaining after five minutes of nebulization was measured. The rebreathing bag and mask were carefully washed out at this time, and the washings assayed for penicillin content. Subtracting this from the amount nebulized gave us the amount received by the subject (table 5) with the exception of that lost through the exhaling valve. A measurable blood level was obtained when a solution containing 75,000 units per cubic centimeter was placed in the nebulizer and at the end of five minutes of inhalation 1 cc. of the 2 cc. remained. The washings of the rebreathing bag and mask gave a recovery value of 12,800 units, leaving a difference of 62,200 units. Aside from the amount lost through the exhaling valve, a part of the penicillin most certainly was dropped in the upper air passages, so that actually an unknown but considerably smaller amount, reached the lung.

These results, as well as the fact that different types of respiration influence the amount of penicillin absorbed from the pulmonary tissue (Segal and Ryder [3]), convince us that the determination of blood levels is unessential if the bacteriologic examination of the sputum is made routinely. As may be seen from table 4, satisfactory clinical progress was obtained with concentrations much lower than those required to produce measurable blood levels.

3. Segal, M. S., and Ryder, C. M.: Penicillin Aerosolization in the Treatment of Serious Respiratory Infections: A Preliminary Report, New England J. Med. **233**:747 (Dec. 20) 1945.

The methods we have used for penicillin assay are those recommended by Rammelkamp,[4] by Randall, Price and Welch [5] and by Heilman and Herrel.[6] Penicillinase was used routinely with methods employing Bacillus subtilis and Staphylococcus aureus; it was found unnecessary with Streptococcus pyogenes (hemolytic streptococcus, group A). In using the Heilman and Herrel method we omitted the transfer of the serial dilutions to the glass slide cell, since the presence or the absence of hemolysis could be easily judged when the small tubes were examined after incubation, and the danger that the cultures would be contaminated during transfer was thus avoided. We estimated streptomycin by the technic of Heilman,[7] using Bacillus megatherium as the test organism and not transferring the serial dilutions to the glass slide.

SUMMARY AND CONCLUSIONS

Ten patients with chronic pulmonary conditions were given penicillin and streptomycin aerosol therapy, and 111 patients of a general hospital, with a variety of diagnoses, were given penicillin aerosol inhalations alone, for a varying period.

The combination of penicillin and streptomycin aerosol therapy is of aid in most cases of bronchiectasis and chronic bronchitis, and of less help in cases of asthma with a possible bacterial factor. In our experience several other drugs have not been as satisfactory in safely eliminating gram-negative bacteria as streptomycin.

Penicillin sodium and streptomycin may be nebulized together, but when penicillin calcium is used, the two antibiotics must be nebulized separately, as the penicillin calcium produces precipitate particles in the presence of streptomycin, which clog the nebulizer.

Once the technic of aerosolization has been established it is not of vital importance to record the presence or the absence of blood levels. We have found that with sixteen treatments per twenty-four hours, a daily total of 200,000 units of penicillin and 500,000 units of streptomycin usually suffices to eliminate bacteria from the sputum and to improve the patient's symptoms.

In our experience relatively few reactions or complications (about 5 per cent) have occurred as a result of the aerosol treatments.

4. Rammelkamp, C. H.: A Method for Determining the Concentration of Penicillin in Body Fluids and Exudates, Proc. Soc. Exper. Biol. & Med. **51**:95 (Oct.) 1942.

5. Randall, W. A.; Price, C. W., and Welch, H.: The Estimation of Penicillin in Body Fluids, Science **101**:365 (April 6) 1945.

6. Heilman, D. H., and Herrel, W. E.: The Use of Flemming's Modification of the Wright Slide Cell Technic for Determining Penicillin in Body Fluids, Am. J. Clin. Path. **15**:7 (Jan. 15) 1945.

7. Heilman, D. H.: A Method for Estimating the Concentration of Streptomycin in Body Fluids, Proc. Staff Meet., Mayo Clin. **20**:145 (May 16) 1945.

The clinical results of aerosolization naturally vary with the case. In pulmonary cases the method is useful as an adjunct to other forms of treatment or as an alternative when surgical intervention is not possible. In some cases of chronic bronchitis or bronchiectasis of the milder type, periodic courses of inhalation therapy may improve the patient's condition sufficiently to be quite beneficial and practical. In cases of more severe type, by reducing the odor and the secretion, they may enable the patient to carry on more satisfactorily.

Aerosol therapy has been established as a hospital procedure, administered by the department of anesthesia to patients in the hospital on the request of any service. More than 100 such patients have been treated, and a number were reported improved. It is difficult to evaluate the results, as various factors were not under our control, such as the indications for aerosol therapy, the length of treatment and the amount of aerosol administered, the additional use of other routes of administration of penicillin, the concomitant use of other drugs, the sufficiency of the laboratory examinations (especially cultures of secretions and roentgen examinations) and the completeness of progress notes and the follow-up. However, we felt that only by this method could penicillin aerosol therapy be made available to hospital patients in a practical manner. A few days of penicillin aerosol inhalations may be very worth while in properly selected cases. Certainly, the treatment appears logical in the preoperative and postoperative management of patients with diseases of the chest and of other surgical patients in whom pulmonary infection exists or appears to be developing.

THE DETAILED AUDIOGRAM

H. A. E. van DISHOECK, M.D.
AND
J. van GOOL
AMSTERDAM, NETHERLANDS

USUALLY audiometric records of the hearing function are taken for the octaves of the (great) C, viz., for the tones of frequencies 128, 256, 512, 1024, 2048, 4096, 8192 H. and. with some audiometers, 9747 cycles per second or a higher value. In this way only eight or nine points of the ideal continuous threshold curve of hearing are fixed. Thus only a rough idea is obtained about the hearing for low, middle and high tones, and all intervening tones are neglected. Since it is known that a great hearing loss may exist in a very small area of the tonal scale, causing a so-called dip, the need of an audiogram more detailed, especially for the higher tones, has become urgent.

Some investigators, struggling with the imperfection of the routine audiogram, made threshold determinations for intervening tones. For clinical use, however, it takes too much time to get a result that is to some extent satisfactory or to obtain records from large groups of people—for example, school children, metal workers or gunners.

For this purpose we developed a method which makes it possible to detect in a short time the hearing loss everywhere on the threshold curve.

PRINCIPLE OF THE DETAILED AUDIOGRAM

In the ordinary audiometric test, for each determination a fixed frequency is chosen, and the intensity is varied till the threshold for this tone is found. This method is inherited from the tuning fork tests. In our method a certain intensity is chosen, and, by turning the frequency dial from the lowest to the highest tone, one can record in which area of the audiogram this howling tone is heard.

If this method is used in testing a person whose hearing is normal and the intensity is increased 5 or 10 decibels at each sweep of the range, one gets the Fletcher-Mumson sensitivity curve.

From the Oto-Laryngological Department, University of Amsterdam; Prof. Dr. A. de Kleyn, director.

METHOD

For our method an audiometer of the sweep frequency type is necessary. We used the Western Electric Audiometer 6-B, producing tones of all frequencies from 100 to 10000 cycles per second.

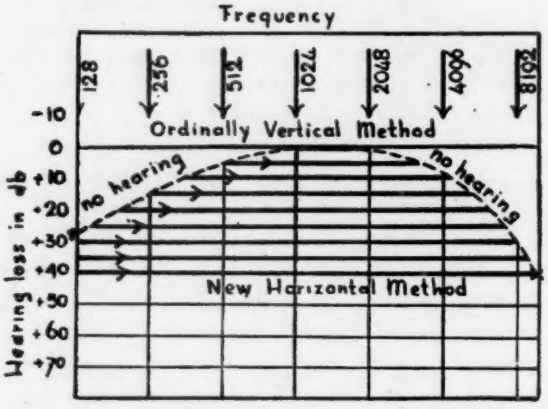


Fig. 1.—Scheme of the way in which the usual vertical and the new horizontal normal audiogram are recorded. The curved line is the isophon of Fletcher and Mumson. This method was developed by us during the war. In studying the literature we found that this same method was suggested, but not used, in 1943 by Bunch [1] and in 1939 by Holmgren.[2] Audiograms taken in this way, however, have never been published.

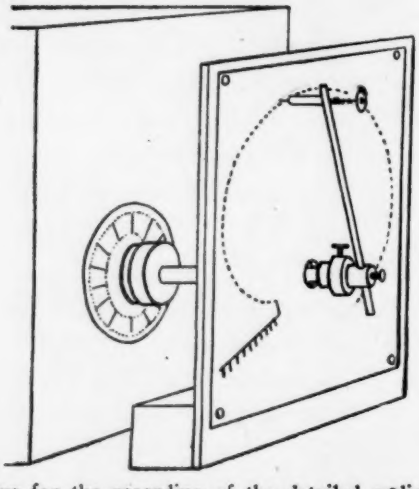


Fig. 2.—Apparatus for the recording of the detailed audiogram attached to a sweep frequency audiometer.

Over the frequency knob of this audiometer a shaft is fixed. A board with an opening in the center of it is placed vertically in front of the audiometer.

1. Bunch, C. C.: Clinical Audiometry, St. Louis, C. V. Mosby Company, 1943, p. 47.

2. Holmgren, L.: Acta oto-laryng., 1939, supp. 34.

Through this opening the lengthened shaft of the frequency knob is passed. An arm with a writing pencil on one end is fixed perpendicularly to the shaft. As the arm is turned, the frequency knob follows this movement; thus the frequency dial is drawn, enlarged, on a card fixed to the board. So each part of the circle corresponds with a special frequency (fig. 3). The accuracy of the audiometer's frequency dial was tested with a pure tone generator.

The first and greatest circle is made with the zero point of the intensity knob on the 1024 reading, that is, with the minimum intensity that can be heard in normal persons, viz., 0 decibels. Only that part of the circle where the tone is heard by the patient is drawn; in the average case of normal hearing it is a small sector corresponding to the frequencies 800 to 2500. Now, the arm with the pencil being shortened and the loudness being increased by 5 decibels, a somewhat greater sector of a circle inside the former one can be drawn, and so on. The greatest difference in sensitivity between the 2048 and the 128 tone being about 40 decibels, eight circles must be drawn in this way with an accuracy of 5 decibels to complete the audiogram of a normal person. In a pathologic case sometimes more circles have to be drawn. We use audiocards carrying the normal isophon of Fletcher for air conduction and other cards for bone conduction. The intensity levels are represented by concentric circles.

THE DETAILED AUDIOGRAM

In every audiogram the loss or gain must be determined in comparison with the normal zero isophon of Fletcher. For a good understanding it is desirable to compare our audiogram with other audiograms of the same patient.

In the American audiogram the normal zero isophon is represented by a straight line. Here the differences in sensitivity for the octaves of C are corrected by different zero positions of the intensity dial; that is, the ciphers beside this dial represent the isophon of Fletcher. In this audiogram one coordinate represents the frequency and the other one the hearing loss. In the well known audiogram of the French and German type the horizontal lines represent a certain output of the audiometer and the isophon of Fletcher is put in as a curve. The audiogram of the patient must be compared with this curve (fig. 3*B*) to measure the hearing loss. As in the French and German audiogram, so in the detailed audiogram, too, the recording of the patient must be compared with the isophon of Fletcher, but now the lines representing the sound levels are not straight lines but circles. Our arrangement makes the O circle on the audiocard represent the sensitivity threshold for the frequencies 800 to 2,500 and the distance between each two inner circles 10 decibels. The isophon of Fletcher is designed in these concentric circles and therefore, in comparison with the French audiogram, is more curved (fig. 4*A*). From this curved audiogram an American hearing loss audiogram can be drawn by simply trans-

mitting on an American audiocard the hearing loss or gain of the patient's curve in comparison with the normal isophon of Fletcher for as many frequencies as are interesting (fig. 4 *B*).

MERITS OF THE DETAILED AUDIOGRAM

The accuracy of our audiogram depends on the promptness of the patient in indicating the moment that his hearing of the howling tone begins and ends. According to our experience, it is much easier to

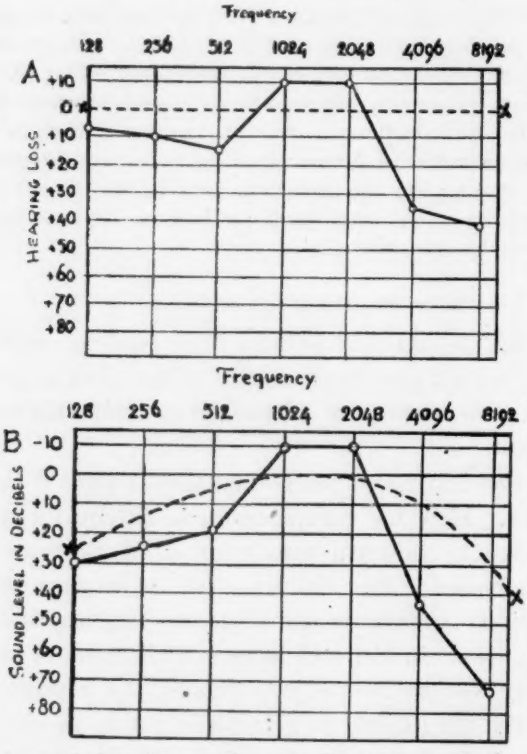


Fig. 3.—*A*, usual American audiogram of a patient who has a hearing loss. The normal isophon of Fletcher is a straight line (*x*——*x*).

B, French sound level audiogram of the same patient. The normal isophon of Fletcher is curved (*x*——*x*).

determine the beginning and the ending of a sound while one is gradually reaching higher pitch than to indicate the threshold of a diminishing pure tone. In our method it is unnecessary and even disturbing to use the interrupter. On repeated testing at the same decibel level, the accuracy of the patient's indication proved to be very satisfactory. So in the case of an abrupt hearing loss the ends of the successive recordings of increasing decibel levels are always in a straight line, one below the other, without recedings or salients (fig. 3 *A*).

An audiogram taken on a 5 decibel scale is more accurate than one on a 10 decibel scale. To save time, we use 5 or even a smaller, number of decibels only to determine certain details—for example, when, by increasing the loudness level by 10 decibels, we suddenly find hearing in a large part of the audiogram, or when we require an exact determination of the form and the depth of a dip. Such a determination, being desirable only in the case of an abnormality and then on a small part of the audiogram, does not take much time, and the exactitude of

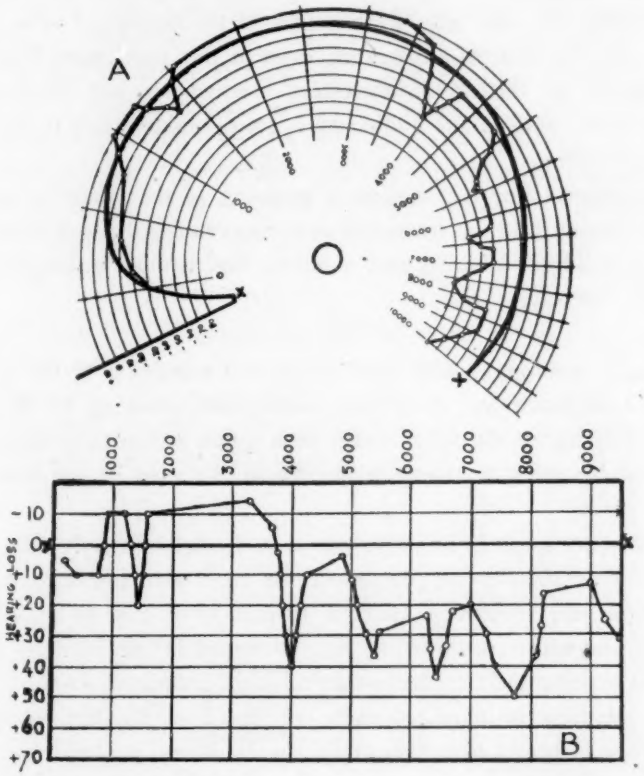


Fig. 4.—*A*, detailed audiogram as it is directly recorded with our method. The normal isophon of Fletcher is more curved (*x*——*x*). The same patient is represented as in fig. 3.

B, detailed audiogram redrawn from the direct recording shown in *A*. This gives a hearing loss audiogram with the normal isophon of Fletcher as a straight line (*x*——*x*). As compared with the usual audiogram (fig. 3 *A*) a great number of dips and other details are now detected.

the whole audiogram is considerably improved. If it is our intention to determine the zero isophon of the patient, only a slow turning of the frequency dial in the neighborhood of the threshold is necessary. When (fig. 3 *A*) at the 10 decibel level the threshold from 1500 to 3500

is determined, this part can be passed quickly at the 20 decibel level. In contrast with the usual methods, we obtain a direct graphic recording. No time is lost in drawing an audiocard afterward, unless a hearing loss audiogram such as that shown in figure 4 *B* is wanted.

This method requires less time than that of obtaining an audiogram with the fixed frequency audiometer. The exactitude is much greater, for all dips and defects in the tonal range can be quickly and easily determined. In the usual audiogram, in the tonal range above 2048—the most interesting part—only three or four determinations are recorded, at fixed frequencies, and only a small part of the audiocard is reserved for them. In the detailed audiogram, even in this part many threshold determinations, at the most interesting frequencies are obtained in pathologic cases, and on the audiocard a considerable space is reserved for their recording.

As the general interest in dips is growing in the clinic as well as in the laboratory and in investigations concerning the prevention of deafness in children, laborers and soldiers, the detailed audiogram can be of great interest.

SUMMARY

The usual audiogram with fixed frequency recording of the octaves of C is not satisfactory. A detailed audiogram, showing all dips and defects of hearing in the tonal range in a quick and easy manner, can be obtained by using a sweep frequency audiometer in the following way:

The intensity knob is fixed on the zero decibel level, viz., the minimum audible at 1000 cycles per second, or 10^{-16} watt per square centimeter. Now the frequency knob is turned from low to high. The tonal range in which the howling tone is heard is recorded by means of a simple writing mechanism mounted on the frequency knob. Afterward the intensity is increased each time by 5 or 10 decibels till the howling tone is heard over the whole tonal range.

OTOLARYNGOLOGIC USES OF SOLUBLE GAUZE (OXIDIZED CELLULOSE)

FLETCHER D. WOODWARD, M.D.
AND
THOMAS HOLT, M.D.
CHARLOTTESVILLE, VA.

IT HAS long been felt that a nonirritating hemostatic absorbable gauze would be most useful in many otolaryngologic procedures and preferable in most instances to fibrin foam or gelatin sponge.

The favorable reports of Frantz and her co-workers [1] stimulated us to investigate the uses of soluble gauze in the field of otolaryngology, and through the cooperation of Dr. John Henderson we have been furnished with generous amounts from Johnson and Johnson during the past nine months for clinical trial.

PREPARATION OF SOLUBLE GAUZE

Oxidized cellulose gauze ("hemo-pak") is a cotton mesh gauze which has been oxidized by being subjected to nitrogen dioxide. It is furnished for our use in strips ½ inch by 2½ yards (about 1 by 228.5 cm.), folded four ply, and prepared from 24 by 20 mesh gauze. It comes in sterile containers, and is used dry.

Oxidized cellulose gauze is neither gauze nor cotton but an entirely new chemical compound, although it closely resembles the original cellulose gauze from which it is made. Kenyon and his co-workers [2] first reported, in 1942, that gauze and cotton could be made absorbable

---

From the Department of Otolaryngology, University of Virginia Hospital.

Read before the Southern Section of the American Laryngological, Rhinological and Otological Society, Inc., Maimi, Fla., Jan. 6, 1947.

1. Frantz, V. K.: Absorbable Cotton, Paper and Gauze, Ann. Surg. **118**:116-126 (July) 1943. Frantz, V. K., and Clarke, H. T.: Hemostasis with Absorbable Gauze, ibid. **129**:181-198 (Aug.) 1944. Frantz, V. K.: New Methods of Hemostasis, S. Clin. North America **25**:338-348 (April) 1945. Frantz, V. K., and Lattes, R.: Oxidized Cellulose—Absorbable Gauze (Cellulosic Acid), J. A. M. A. **129**:798-801 (Nov. 17) 1945. Frantz, V. K.: New Absorbable Hemostatic Agents. Bull. New York Acad. Med. **22**:102-110 (Feb.) 1946.

2. Yackel, E. C., and Kenyon, W. O.: The Oxidation of Cellulose by Nitrogen Dioxide, J. Am. Chem. Soc. **64**:121-127 (Jan.) 1942. Unruh, C. C., and Kenyon, W. O.: Investigation of the Properties of Cellulose Oxidized by Nitrogen Dioxide, ibid. **64**:127-131 (Jan.) 1942.

by oxidation with nitrogen dioxide. As a result of this treatment, carboxyl groups are formed which render the material absorbable in dilute alkali. By altering the oxidation time, the carboxyl content can be altered, the percentage of which determines the chemical and physical properties of the material treated. There must be present a minimum of 13 per cent carboxyl groups for dissolution to occur in organic fluids. Oxidized cellulose gauze contains approximately 20 per cent carboxyl groups.

Sterilization.—Formaldehyde is used during the manufacturing process to insure sterility, but when the process is finished, such small traces are left that they are nonirritating. The gauze cannot be autoclaved, but it can be boiled for three minutes or soaked in 70 per cent alcohol. However, we prefer to use it dry from the original sterile container.

TISSUE REACTION

Numerous experiments by Lattes and Frantz [3] showed that the oxidized cellulose was nontoxic and practically nonirritating to animals and that it was absorbed in from a few days to a few weeks, depending on the amount and the site of the implant.

The implanted gauze soon forms a gelatinous brownish mass, which at first swells and then is gradually absorbed by macrophages and tissue fluid. This process is accompanied by a mild inflammatory foreign body reaction.

HEMOSTASIS

Its specific hemostatic property seems to be due to the formation of a coagulum consisting of salts of cellulosic acid (polyanhydroglucuronic acid) and hemoglobin, plus mechanical tissue pressure. When applied to a bleeding surface, it swells, turns black and sticks. This adherence is about as strong as the true clot which forms when fibrin foam or gelatin sponge is used as a carrier for thrombin in the treatment of surface bleeding. The dry gauze is more effective than wet gauze, and with pressure will control massive oozing. All major bleeding points should be controlled by established surgical procedures. Soluble gauze is not recommended as a surface dressing for open wounds except to the extent of its hemostatic effect, which is temporary.

The coagulum can be removed in from one to a few days by spot suction or by irrigation and without danger of further bleeding, because the wound surface is covered by a thin film of the coagulum; or it can be left in situ until absorbed in from a few days to a few weeks by phagocytosis and tissue fluid when buried; or it may be expelled by natural means from open cavities.

---

3. Lattes, R., and Frantz, V. K.: Absorbable Sponge Tests, Ann. Surg. **121**: 894-896 (June) 1945; Absorbable Gauze in Bone Surgery, ibid. **124**:28-39 (July) 1946.

Oxidized cellulose gauze has been used by us in approximately 100 cases, with excellent results and no secondary hemorrhages. Its use is now practically routine, to the exclusion of regular gauze packs.

Our records on its use are complete in 75 cases. An enumeration of these will best illustrate the uses to date. These cases were:

Spontaneous nasal hemorrhage, lateral wall	8
Submucous resection of nasal septum	6
Polypectomy	6
Biopsy of vascular nasal tumors	3
Compound fracture of nose	2
Antrostomy	5
Intranasal ethmosphenoidectomy	3
External frontoethmosphenoidectomy	15
Radical excision of malignant tumors of nose, sinuses, palate and adjacent structures	10
Resection of submaxillary gland	1
Fibroma of nasopharynx	1
Injury of brain and dural tear	1
Postadenoidectomy hemorrhage, primary	1
Postadenoidectomy hemorrhage, secondary	1
Radical mastoidectomy	12

SUMMARY

As a result of our experience, we recommend that oxidized cellulose gauze be used for the control of oozing in all types of otolaryngologic procedures. By its use secondary hemorrhage was practically eliminated. In 1 case in which a biopsy of a nasal fibroma was made, the nose had to be repacked. We have experienced no untoward effects; in fact, oxidized cellulose gauze has been so satisfactory that it has practically supplanted the used of regular gauze in our department.

104 East Market Street (Dr. Woodward).

PROPHYLACTIC VALUE OF SULFATHIAZOLE

An Experiment Designed to Test the Efficacy of Sulfathiazole Gum in Reducing the Bacterial Flora Causing Infectious Pharyngitis

IRWIN S. NEIMAN, Ph.D., M.D.
CHICAGO

WITH the advent of the newer therapy for infectious diseases there has been an increase in the use of more or less specific drugs for prophylactic purposes. The idea of chemoprophylaxis is not a new one. There has been widespread use of quinine to prevent malaria and of certain silver preparations to prevent gonorrhea. However, it is only in recent years that sulfonamide drugs have been used to prevent the infectious diseases caused by hemolytic streptococci.[1] The results have been attended with a good deal of success, especially those reported by the armed services. Under circumstances such as those occurring in large concentrations of men in camp units, diseases of the upper respiratory tract of all types find an optimal environment for expression. However, a question has been raised as to the expediency of using these methods in civilian populations.

The oropharyngeal route of invasion is commonly the one followed in many streptococcic infections of man. This route is protected by an extremely efficient nonspecific mechanism residing in the tonsillar ring. Whether or not infectious agents cross this barrier to invade other susceptible organs and tissues or establish a focus of infection in the pharynx is dependent on three other factors.

The first is dosage. This concerns itself with the number of organisms which accost the oropharynx at any particular time. The greater the number, the greater is the possibility of initiating an infection.

From the Department of Bacteriology and the Student Health Service of the Chicago Medical School.

1. Kuhns, D. M., and Feldman, H. A.: Laboratory Methods Used in Determining Value of Sulfadiazine as a Mass Prophylactic Against Meningococci Infections, Am. J. Pub. Health **33**:1461, 1943. Coburn, A. V.: Prevention of Respiratory Tract Bacterial Infections by Sulfadiazine Prophylaxis in United States Navy, J. A. M. A. **126**:88 (Sept. 9) 1944. Gooch, J. O., and Gorby, A. L.: Use of Sulfathiazole as Prophylactic Agent, Mil. Surgeon **94**:339, 1944. Gettelman, E., and Kaiz, S. P.: Treatment of Severe Tonsillitis in Naval Dispensary, U. S. Nav. M. Bull. **42**:399, 1944.

The second is the virulence of the invading strain of organisms. This is a notoriously variable characteristic which depends on little understood intrinsic features of the infectious agent. Obviously, the higher the degree of virulence, the greater is the possibility of initiating infection.

The third is the specific resistance of the host. This factor coupled with the nonspecific action of the tonsillar ring stands opposed to the invading agent. The degree of resistance will depend on whether or not the host has had previous experience with the particular organism involved. A person who has recovered from a streptococcic infection is less liable to get a new infection with the same strain of streptococcus than one who has had no such experience. It seems reasonable to state that the greater the resistance the less chance there is for the initiation of an infection. However, since there are so many different types of streptococci to which man is susceptible, the specific resistance created by experience with one type is not to be emphasized.

All of the chemoprophylactic experiments cited in a foregoing paragraph were concerned with maintaining a basic blood level of the sulfonamide drug by administering a maintenance dose daily. This method may be criticized on two counts: that it invited reactions in sensitized persons, and that it created sensitivities needlessly. Since dosage is a factor in initiating infection and since the oropharyngeal portal of entry is often used by streptococci, it seems reasonable to obtain, if possible, a high level of a sulfonamide drug in the saliva in order to decrease the number of viable bacteria gaining entrance and to lend support to the nonspecific defense mechanism of the oropharynx. Sulfathiazole administered in a vehicle such as chewing gum or in the form of a lozenge, it was thought, would adequately serve such a purpose. Both types of product were procurable on the market. Fox and co-workers [2] reported on the in vivo bactericidal effects of sulfathiazole contained in gum. In these reports the authors showed a reduction of total bacterial flora of the oropharynx and in particular a therapeutic effect on diseases of the oropharynx caused by hemolytic streptococci. A report of Harrison and Rees [3] gives evidence of the high level of sulfathiazole obtained in the saliva during the chewing of gum containing the drug. Consequently, an experiment was designed to determine the efficacy of a gum containing sulfathiazole in preventing the occurrence of infectious pharyngitis, with particular emphasis on inflammations of streptococcic causation.

2. Fox, N.; Kesel, R. G.; Neary, E. R., and Herbine, R. H.: Effect of Sulfathiazole in Chewing Gum in Certain Oropharyngeal Infections, Arch. Otolaryng. **41**:278 (April) 1945. Fox, N., and Kesel, R. G.: Hyperplastic Sinopharyngostomatitis, ibid. **42**:368 (Nov.-Dec.) 1945.

3. Harrison, J. W. E., and Rees, E. W.: A Study of the Salivary Sulfathiazole Levels Produced by Sulfathiazole Gum, Am. J. Pharm. **117**:204, 1945.

MATERIAL AND METHODS

The subjects of the study were medical students, who were divided into three groups, A, B and C: Group A chewed one sulfathiazole gum tablet [4] three times daily. Group B chewed one unmedicated gum tablet three times daily. Group C chewed one medicated gum tablet once daily.

Each student was instructed to chew the gum tablet at least thirty minutes, preferably longer, before discarding it. Those chewing three a day were asked to chew the first tablet shortly after arising in the morning, the second in the middle of the day and the third before retiring. Those in group C were asked to chew the one tablet shortly before retiring.

No selection was made of subjects as to the various groupings. Persons were placed in groups alternately as they applied for the gum. However, group C was purposely kept smaller than groups A and B. Persons falling into group B were not told that they were controls, although the gum tablets were of another color than the green of the sulfathiazole gum. The questions that naturally arose were circumvented by saying that the different colored tablets had "different concentrations of sulfathiazole."

Each subject was required to report routinely at two week intervals, at which times a history was taken of the happenings of the previous two weeks and a two week supply of gum was issued. Gum tablets that were not used were turned in, and a record was kept of the number of tablets actually chewed. Persons who had complaints referable to the upper respiratory tract were asked to report to the student health office at once whether or not they were due for a regular two week visit. Complaints were thoroughly investigated and cultures taken of the oropharynx whenever indicated.

RESULTS

The total number of persons cooperating in the experiment was 199. A detailed record was kept of the incidence of common colds, irritational or secondary pharyngitis and infectious or primary pharyngitis. For the purpose of this study, a common cold was defined as simple rhinitis with no signs or symptoms other than those referable to the nose. Irritational pharyngitis was defined as mild inflammatory involvement of the pharynx characterized by little or no fever, hyperemia or sensation of rawness and usually secondary to rhinitis or sinusitis. Infectious pharyngitis was defined as the classic hyperemic and purulent inflammation of the pharyngeal tissues with fever and usually with cervical lymphadenopathy. Cultures of material taken from throats showing the primary types of pharyngitis often yielded hemolytic streptococci.

The experiment was continued for a period of eight months extending from October 1944 to June 1945 and thus covering those seasons of the year when pharyngitis is most prevalent. In the table the results are summarized, first, by individual classes to show that there was a division into the three groups in each class. The incidence of

4. The sulfathiazole gum was supplied by White Laboratories, Inc., Newark, N. J.

each of the three common types of infections of the respiratory tract studied is given for each of the individual classes and groups. Second, the incidence for the total number of persons involved is recorded. Finally, the incidence in group A is combined with that in group C to be compared with the incidence in the control group. The rates used are based on person-weeks observation. This device has allowed for the use of all students cooperating for the full period or a part of the period. A graphic comparison of the rates is depicted in the chart.

It is to be noted that the rates of incidence of all three conditions were lower in the groups taking sulfathiazole gum. There were 25 per

Summary of the Results of the Experiment

Class	Total Number of Subjects	Number in Each Group	Person-Weeks on Experiment	Colds		Irritational Pharyngitides		Infectious Pharyngitides	
				No.	Rate per 100 P.-W.	No.	Rate per 100 P.-W.	No.	Rate per 100 P.-W.
I	35	A 13	344	19	5.52	7	2.03	5	1.45
		B 12	302	17	5.62	11	3.64	7	2.32
		C 10	276	17	6.16	7	2.54	2	0.72
II	67	A 28	812	38	4.18	16	1.97	2 (2)*	0.24
		B 26	782	41	5.24	28	3.58	9	1.15
		C 13	420	14	3.33	11	2.62	0	
III	58	A 24	666	31	4.65	25	3.90	5 (3)*	0.75
		B 21	570	39	8.02	19	3.33	7	1.23
		C 13	372	16	4.30	13	3.49	1	0.27
IV	39	A 14	254	12	4.72	3	1.14	2 (2)*	0.78
		B 16	334	22	6.58	11	3.29	1	0.29
		C 9	194	2	1.03	5	2.58	1	0.51
All classes combined	199	A 79	2,076	100	4.82	51	2.46	14 (7)*	0.67
		B 75	1,986	119	5.98	69	3.47	24	1.21
		C 45	1,262	49	3.89	36	2.85	4	0.32
All classes combined	199	A and C 124	3,338	149	4.46	87	2.61	18 (7)*	0.54
		B 75	1,988	119	5.98	69	3.47	24	1.21

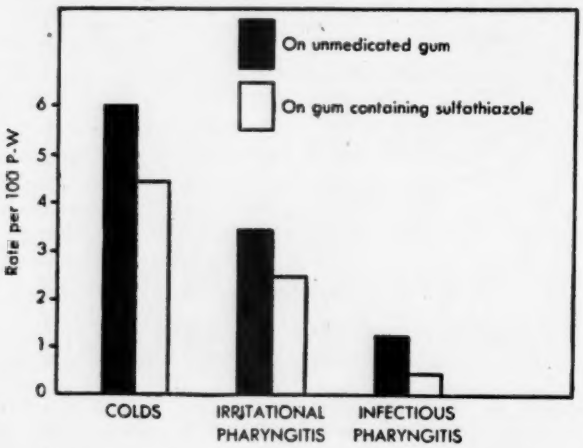
* These occurred during periods when the subjects were not taking gum.

cent fewer colds and secondary pharyngitides. This, of course, is not so great a difference that one is warranted in drawing conclusions. However, it agrees with the generally lower rates of incidence of diseases of the upper respiratory tract cited in the reports coming from other investigators studying the prophylactic value of maintenance doses of orally administered sulfathiazole.

The chief concern in the present study was the incidence of primary pharyngitis. The incidence of this disease was $\frac{1.21}{0.54}$ or 2.4 times as high among the controls chewing unmedicated gum as among the subjects chewing the medicated gum. It seemed pertinent to determine whether this difference was of statistical significance. The standard

error of difference was determined for the combined groups A and C and group B. This was found to have a value of ± 6.3. The actual difference was 17.5. In order for any difference of proportions to be statistically significant, the actual difference should be at least twice the standard error and preferably should approach 3 times that value. In this instance the actual difference is 2.8 times the standard error. Examination of the appropriate biometric table indicates that this result can occur accidentally once in 400 trials.

The difference observed between the treated and control groups may be given even added significance if one considers the difficulties inherent in getting people to cooperate fully in this type of experiment. It also should be pointed out that the 7 pharyngitides that occurred in persons during periods when they were not chewing gum are not figured in



A comparison of the rates of incidence of colds, irritational (or secondary) pharyngitis and infectious (or primary) pharyngitis. *P-W* stands for person-weeks (see text).

the rates. If they were, the corrected incidence per 100 person-weeks would be 1.56 for the controls, which makes the incidence almost 3 times as high as among those chewing sulfathiazole gum.

COMMENT

The results of an experiment designed to test the efficacy of the local action of sulfathiazole in reducing the pathogenic bacterial flora of the oropharynx are reported. The method employed concerned itself with the incidence of clinically apparent infections rather than with bacterial counts. As was indicated in a foregoing paragraph, the other methods of chemoprophylaxis utilizing sulfonamide drugs have been criticized because, among other things, of the possibility of creating needless hypersensitivities. By administering the drug in a vehicle

such as chewing gum, an extremely high concentration of the drug was obtained locally, but in no single instance was a reaction reported, either of a local or of a general character. It was believed that this absence of reactions despite the fact that the drug was taken regularly over a relatively long period was due to the low total daily dose (0.25 to 0.75 Gm.) and the slow rate of absorption. Repeated testing of blood samples drawn from unselected persons gave in no case a positive result for sulfathiazole. It was felt that the absence of reactions indicated that no sensitivities were being created.

Leftwich [5] recently reported a test for sulfonamide drug sensitivity which seemed worthy of a trial. This test involves two simultaneous intradermal injections, one with 0.05 cc. of serum taken from a person having a blood sulfonamide level of greater than 2 mg. per 100 cc., and the other wth 0.05 cc. of normal human serum. In each injected area a wheal will appear immediately. However, according to Leftwich, in those persons who are sensitive to the particular sultonamide drug present in the serum containing a sulfonamide drug, the wheal in the area of the injection of sulfonamide serum will be 4 mm. or more greater than the wheal in the area of the injection of normal serum. This test was applied to 20 subjects who had been taking sulfathiazole daily for three to four months. In 19 of them the result was negative, and in 1 it was positive. This person had a history of a sulfonamide drug reaction in the past, but had had no ill effects from taking the sulfathiazole gum.

This study presents no evidence to contradict the contention that needless drug reactions occur in unknown hypersensitive persons when sulfathiazole is used prophylactically on a mass basis. It can be stated only that subjects were individually and collectively warned of the possible occurrence of local reactions. They were asked to stop taking the gum at once and report any untoward reaction to the student health officer. The numbers of subjects involved are insufficient to allow the drawing of conclusions. It is worthy of note that the mouths of over 100 persons were exposed to the drug in concentrated form daily for eight months, with no untoward effects. It would be more conservative to explain this result as fortuitous.

There have been several reports [6] in which the question was raised whether sulfonamide drugs should be used promiscuously, since drug-resistant strains of bacteria develop and their usefulness might be obviated. This point deserves serious consideration, but the belief is herewith expressed that physicians should be concerned primarily with

5. Leftwich, W. B.: Intradermal Test for the Recognition of the Hypersensitivity to Sulfonamide Drugs, Bull. Johns Hopkins Hosp. **74**:26, 1944.

6. Sulfadiazine Resistant Strains of Beta Hemolytic Streptococci, Epidemiology Unit no. 22. J. A. M. A. **129**:921 (Dec. 1) 1945.

a means of reducing the incidence of diseases caused by sulfonamide-sensitive strains of pathogenic bacteria. Long strides have been made in the development of nontoxic chemotherapeutic substances. It is my belief that advantage should be taken of the usefulness of a drug for as long a time as efficiency is demonstrable. When the time is reached that the drug is no longer effective as a chemotherapeutic or a chemoprophylactic agent because resistant strains of bacteria have appeared, or for any other reason, it may then be discarded. One may depend on the development of newer and possibly more efficient substances to replace it.

SUMMARY AND CONCLUSIONS

The results of an experiment designed to determine the prophylactic value of sulfathiazole are reported.

Within the limits of this type of study there seems to be a diminution in the incidence of primary streptococcic pharyngitis in persons chewing three sulfathiazole gum tablets daily.

Again within the limits of this study, no cases of sensitization were revealed when sulfathiazole was administered locally in a gum vehicle, as determined by the so-called Leftwich test, nor were any reactions of hypersensitivity reported by the participants.

ACUTE FRONTAL SINUSITIS

ERNEST D. JOHNSON, M.D.
ALHAMBRA, CALIF.

FRONTAL SINUSITIS is one of the most serious diseases with which the rhinologist has to cope. Particularly is this true when he is confronted with acute frontal sinusitis, the complications of which may ramify throughout the length and breadth of the skull. Of these complications, the most common one is osteomyelitis of the frontal bone. Also among the more common complications are periorbital abscess, epidural abscess, subdural abscess, brain abscess and meningitis.

HISTORICAL CONSIDERATIONS

Prehistoric skulls have been unearthed showing frontal trephine openings, which suggest that surgical treatment for frontal sinusitis was practiced by early man. One of these skulls, unearthed in Cinco Cerros, Peru, is shown in figure 1. It has a large trephine opening in the frontal area. It will be noted that the margins of the opening are healed, and it is presumed that the patient survived his trephine operation and died of some other cause. Skulls trephined in a manner similar to that employed by the ancient Incas have recently been excavated in Palestine.[1] They are said to date from about 700 B.C. Trephining was practiced freely in the time of Hippocrates, 460 to 377 B.C., and later, during the periods of Celsus, Galen and others. The various trephines used included the terebra, the modiolus, the incisoria and others, the descriptions of which are interesting but will be omitted.

It is estimated that 5 to 6 per cent of ancient skulls excavated in Peru show that trepanning was done not only to alleviate effects of injury or disease but also to obtain amulets, which were worn as charms to let evil spirits out and good ones in.

ANATOMY

The frontal sinuses are cavities of various size and shape confined between the outer and the inner plate of the frontal bone. They extend upward, backward and lateralward for a variable distance. They are separated, one from the other, by a thin bony septum which often deviate to one side or the other, with the result that the sinuses are

1. Thompson, C. J. S.: History and Evolution of Surgical Instruments, New York, Schuman's, 1942.

rarely symmetric. (They are absent at birth and reach their full size only after puberty.)

Roughly there are (1) an anterior thick wall, (2) a thin floor and (3) a thin roof. The roof of the sinus forms part of the floor of the anterior fossa of the skull, while the floor forms the anterior superior part of the roof of the orbit. At the inner angle of the orbit under the supraorbital ridge is a comparatively thin portion known as Ewing's point which is the usual point of entry for trephining the frontal sinus.

Leading downward, sometimes directly more often indirectly, is a pathway known as the frontonasal duct, which emerges high up in the middle meatus. Once the frontal sinus is infected, the pathologic progress

Fig. 1.—Skull unearthed in Cinco Cerros, Peru, showing a trephine opening in the frontal area. (Courtesy of the United States National Museum, Washington, D. C.)

is determined to a great degree by the structure and the patency of this pathway. The outer angle of the sinus is somewhat dependent, and inadequate drainage there is responsible for much pathologic change. Also the presence of septums may impede drainage.

The diploic veins of the skull are numerous. They connect superficially with the veins of the scalp and have deep connections with all blood sinuses of the skull. They are branches of the frontal veins, which open into the supraorbital veins, and the longitudinal veins and the anterior temporal vein, which is confined chiefly to the frontal bone and opens into the sphenoparietal sinus and into one of the deep

temporal veins through an aperture in the great wing of the sphenoid bone. Two fairly constant plexuses occur at the outer angles in the region of the frontal bossas. Others may be seen to course through the wall of the frontal bone and enter blood lakes, which in turn empty into the longitudinal sinus.

INCIDENCE

A survey of the patients entering the ear, nose and throat service of the Los Angeles General Hospital was made, covering a period of ten years from 1935 to 1945, to determine the incidence of frontal sinusitis. During this period 51,692 patients with diseases of the ears, nose and throat were seen in the outpatient department. Of these, 22,513 were hospitalized. Sixty-eight of these, or approximately 0.03 per cent, had frontal sinusitis which required hospitalization. In 6, or 8.8 per cent, of the 68 patients with frontal sinusitis, osteomyelitis of the frontal bone developed. The youngest was 9 and the oldest 62. There were two and a half times as many males as females. There were apparently twice as many left frontal sinuses involved as right frontal sinuses. There were 6 deaths.

McKenzie,[2] in 1913, published the most extended article on the subject of the rarity of this disease and its tendency to be more progressive in patients between 15 and 30, a fact which he attributes to the great development of the bones of the skull during adolescence and early adult life.

Over a period of twenty years MacMillan [3] encountered 86 patients with osteomyelitis developing from frontal sinusitis in the Massachusetts Eye and Ear Infirmary—in other words, about 4 a year in an institution that has an active ear, nose and throat service.

Osteomyelitis of the frontal bone is rare according to Abbott and Bulson.[4] They searched the American and European literature and found 55 cases occurring in thirty years. Thirty-seven of the patients died. In 27 cases the osteomyelitis occurred as a result of acute suppuration of the frontal sinus. In 16 cases osteomyelitis developed after the first operation.

PATHOLOGIC ASPECTS

I believe that most physicians are in agreement in their convictions that acute frontal sinusitis is the chief cause of osteomyelitis of the frontal bone. Brown [5] made this statement and also stated that

2. McKenzie, J.: Osteomyelitis, J. Laryng., Rhin. & Otol. **28**:6-129 (Jan.) 1913.

3. MacMillan, A. S.: Osteomyelitis of the Skull Following Frontal Sinusitis, J. A. M. A. **115**:1176-1178 (Oct. 5) 1940.

4. Bulson, A. E., Jr.: Osteomyelitis of the Frontal Bone as a Complication of Frontal Sinusitis, J. A. M. A. **86**:246-250 (Jan. 23) 1926.

5. Brown, L. A.: Osteomyelitis of Frontal Bone, Arch. Otolaryng. **39**: 485-491 (June) 1944.

Sixty-Eight Cases of Frontal Sinusitis Tabulated from the Files of the Los Angeles County General Hospital Covering a Period of Ten Years—from 1935 to 1945

Case	Sex	Age	Race	Etiologic Factor	Bacteremia	Operation	Complication	Result
1	M	21	W	Infection*	None	None	.....	Recovery
2	M	25	Jap.	Infection	None	Trephination	Meningitis	Death
3	M	21	W	Allergy	None	Trephination	.....	Recovery
4	F M	24	W	Infection	None	None	Orbital cellulitis	Recovery
5	F M	11	W	Infection	None	Trephination	None	Recovery
6	F M	16	W	Infection	Staph. aureus	None	Subdural abscess	Death
7	M	44	W	Infection	Staph. aureus	Trephination	None	Recovery
8	M	51	W	Infection	None	Trephination	None	Recovery
9	M	26	W	.....	None	None	None	Recovery
10	M	10	W	.....	None	Trephination	Orbital abscess	Recovery
11	M	26	W	Infection	None	None	None	Recovery
12	M	9	W	.....	None	None	None	Recovery
13	M	29	W	.....	None	None	Subdural abscess	Death
14	M	16	W	.....	None	Trephination	Meningitis	Recovery
15	F M	16	W	.....	None	Trephination	Subperiosteal abscess, osteomyelitis	Death
16	F M	48	Negro	Infection	Staph. aureus	Trephination	Meningitis	Death
17	M	16	W	.....	Staph. aureus	Trephination	Extradural abscess	Death
18	M	17	W	Infection	Staph. aureus	Trephination	None	Recovery
19	M	52	W	Infection	Staph. aureus	None	None	Recovery
20	M	24	W	Infection	None	Trephination	None	Recovery
21	M	23	W	Infection	Staph. aureus	Trephination	None	Recovery
22	M	28	W	Infection	Staph. aureus	Trephination	None	Recovery
23	M	13	W	Infection	None	Trephination	None	Recovery
24	M	11	W	Angina	None	None	None	Recovery
25	F M	20	Mex.	Infection	None	None	None	Recovery
26	F M	19	W	Swimming	None	None	None	Recovery
27	M	19	W	Infection	Staph. aureus	Trephination	None	Recovery
28	M	44	W	.....	None	None	None	Recovery
29	F M	25	W	Infection	None	None	None	Recovery
30	M	31	W	Infection	None	None	None	Recovery
31	M	15	W	.....	None	None	None	Recovery
32	M	13	W	Infection	Staph. aureus	Trephination	None	Recovery
33	M	21	W	Swimming	None	None	None	Recovery
34	M	16	Negro	Infection	Staph. aureus	Trephination	Orbital abscess	Recovery
35	M	19	W	Infection	Staph. aureus	Trephination	None	Recovery
36	M	9	W	Angina	Staph. aureus	Trephination	None	Recovery
37	M	35	W	Infection	None	None	None	Recovery
38	M	18	W	Infection	None	None	None	Recovery
39	M	14	W	Infection	Staph. aureus	Trephination	None	Recovery
40	M	14	W	Swimming	Staph. aureus	Trephination	None	Recovery
41	M	9	W	Swimming	Staph. aureus	Trephination	Osteomyelitis	Recovery
42	M	17	W	.....	None	None	Fulminating osteomyelitis	Death
43	F M	32	Negro	Infection	None	None	None	Recovery
44	M	40	W	"Flu"	None	None	None	Recovery
45	M	24	W	Infection	None	Trephination	Osteomyelitis	Recovery
46	M	25	W	Infection	None	Trephination	Meningitis	Death
47	M	14	W	Swimming	None	Trephination	None	Recovery
48	F M	23	W	Infection	Staph. albus	None	None	Recovery
49	M	14	W	Swimming	Staph. aureus	Trephination	None	Recovery
50	M	21	W	Infection	None	None	None	Recovery

* In all instances infection means infection of the upper respiratory tract.

Sixty-Eight Cases of Frontal Sinusitis Tabulated from the Files of the Los Angeles County General Hospital Covering a Period of Ten Years—from 1935 to 1945—Continued

Case	Sex	Age	Race	Etiologic Factor	Bacteremia	Operation	Complication	Result
51	M	21	W	Infection	None	Trephination	Periorbital abscess, osteomyelitis, epidural abscess, meningitis	Death
52	F M	13	W	Infection	None	Trephination	Osteomyelitis, epidural abscess	Death
53	F M	28	W	Infection	None	Trephination	None	Recovery
54	M	26	W	Swimming	Staph. albus	Trephination	Subdural abscess	Recovery
55	F M	9	W	Measles	None	Trephination	None	Recovery
56	M	15	W	Infection	Staph. albus	Trephination	Frontal lobe abscess	Death
57	M	25	W	Infection	None	Trephination	None	Recovery
58	F	12	W	Infection	None	None	None	Recovery
59	M	20	W	Infection	None	None	None	Recovery
60	M	27	W	Infection	None	None	None	Recovery
61	M	33	W	Infection	None	None	None	Recovery
62	M	23	W	Infection	None	None	None	Recovery
63	F M	14	W	Infection	None	None	None	Recovery
64	F M	23	Negro	Infection	None	None	None	Recovery
65	F	62	W	Infection	None	Trephination	None	Recovery
66	M	43	M	Infection	None	None	None	Recovery
67	F M	23	W	Infection	None	None	None	Recovery
68	F	27	W	Infection	None	None	None	Recovery

osteomyelitis of the frontal bone is less likely to be caused by chronic frontal sinusitis, because during the disease the frontal bone tends to form its own barriers to the spread of infection. He expressed the belief that trauma induced by the external approach contributes to the onset of osteomyelitis of the frontal bone. Compound fracture could be a cause, of course, and rarely osteomylitis can be the result of a blood-borne infection.

Going on with his discussion, he outlined the production of osteomyelitis as follows:

1. The mucosa of the frontal sinus becomes infected.
2. The blood vessels coming from the mucosa into the bone become filled with septic thrombi.
3. The blood vessels of the diploe connecting the frontal sinus with the blood lakes of the frontal bone, which are located close to the coronal suture, become filled with septic thrombi.
4. Sections of bone involved die, decalcify and are sequestered.
5. Both tables are involved, the inner faring worse, and it is from the latter that the more serious complications arise.

Mosher [6] has given his views of the pathologic processes involved in osteomyelitis of the frontal bone. In 1936 he reported the results of observations made in 3 cases of osteomyelitis of the frontal bone: In the acute stage the marrow spaces were crowded to overflowing with

6. Mosher, H. P.: Osteomyelitis of the Frontal Bone: Notes on Three Cases, J. A. M. A. **107**:942-947 (Sept. 19) 1936.

large and small lymphocytes. The majority of the marrow spaces were infected, and many of them contained actual abscesses. Some fibrous tissue was present, but it did not predominate. Infected vessels were found making their way to the surface of the bone both externally and internally. The infections broke through the inner table more frequently than the outer table. The current of infection appeared to be inward rather than outward.

In a later stage there was actual abscess formation in the marrow spaces near the necrotic area. In other parts of the bone the predominant picture was fibrosis of the marrow spaces. This extensive fibrosis suggested that the greater part of the invading organisms had been conquered and walled off except along the tract of the infected vein. Infection was found to extend in all directions to the edge of the bone removed.

Mosher [6] stated that necrosis of bone does not occur until seven or ten days after the pitting edema and that the roentgenogram is not positive until necrosis begins. Examination of bone specimens showed that infection spreads along the inner surface of the bone as well as by the diploic veins. When spreading by diploic veins it may localize far from the original source of infection. When it does localize, the process tends to work inward or outward, giving rise to either an extradural abscess or a subperiosteal abscess, with destruction of bone between. If a case has lasted two or three weeks, one may expect both of these conditions.

Mosher [7] considered two types of osteomyelitis: the fulminating type and the less violent localizing form. If the patient was septic and showed pitting edema halfway or all the way to the hair line, he considered the case one of the fulminating type.

McKenzie [2] minimized the part played by the diploe of the bone in relation to the frontal sinus, although he believed the infection spread more once it reached the diploe. He held that diffuse osteomyelitis is not limited in its spread to diploic bone only. As the disease spreads it involves the hard bones—the ethmoid bone, the lacrimal bone and even the frontal eminences, where the diploic structure may be entirely deficient. The disease spreads in any direction, but the larger zone is toward the base of the cranium, where so many portals pierce the cranial fortifications.

Furstenberg [8] stated that infection may spread by extending directly from the mucous membrane of the sinus to the diploe and by involving

7. Mosher, H. P.: Osteomyelitis of Frontal Bone as a Complication of Frontal Sinusitis, Tr. Sect. Laryng., Otol. & Rhin., 1940, pp. 141-151; Osteomyelitis of Frontal Bone as Complication of Frontal Sinusitis, J. A. M. A. **115**:1179-1182 (Oct. 5) 1940.

8. Furstenberg, A. C.: Pathology of the Spread of Osteomyelitis of the Skull. Laryngoscope **44**:470-476 (June) 1934.

the blood vessels. The thrombophlebitis which exists penetrates the cerebral wall of the frontal sinus and spreads through the diploic system of vessels within the dura mater, and exudate forms between the dura and the skull. As a result the blood supply of the bones is cut off, which tends to deprive them of nutrition and lays them open to widespread infection from the sinus.

Dill [9] agreed that the most common etiologic factor in osteomyelitis of the frontal bone is frontal sinusitis and that it occurs spontaneously or postoperatively. The disease may be acute or chronic, or a flare-up of chronic frontal sinusitis.

Williams and Heilman recognized three types of osteomyelitis: (1) localizing, (2) fulminating and (3) spreading.

Courville [10] and Rosenwald demonstrated that osteomyelitis develops only when thrombosis occurs and that in some instances infection may pass through the veins into the superior longitudinal sinus and thence retrograde in the same or the opposite cerebral hemisphere without the venous walls becoming infected. In such a case an abscess of the brain may occur without the development of intervening osteomyelitis. They demonstrated that infection which spreads by thrombophlebitis may lodge in any part of the frontal lobe or any part of the brain. They cited a case of an abscess of the eyelid in which the infection spread to the temporal muscle and thence by an emissary vein into the anterior temporal diploic vein, giving rise to localized osteomyelitis of the temporal and the frontal bone.

Bucy and Haverfield [11] expressed the belief that the most common complications of frontal sinusitis, particularly those which follow swimming, are abscess of the the frontal lobe and osteomyelitis of the frontal bone. McKenzie [12] stated that he could not entirely accept the classification of localized osteomyelitis and spreading osteomyelitis, as he felt it was impossible to prophesy which will remain localized and which will spread.

MacMillan [13] stated truly that serious complications may occur simultaneously with bone infection so that an apparently solid posterior wall of an infected frontal sinus may be covering an extradural or a brain abscess. This is so, because the thrombosed vessels of the mucous

9. Dill, J. L.: Osteomyelitis of Frontal Bone, Laryngoscope **52**:267-274 (April) 1942.

10. Courville, C. B.: Subdural Empyema Secondary to Purulent Frontal Sinusitis, Arch. Otolaryng. **39**:211-230 (March) 1944.

11. Bucy, P. C., and Haverfield, W. T.: Cranial and Intracranial Complications of Acute Frontal Sinusitis, J. A. M. A. **115**:983-991 (Sept. 21) 1940.

12. McKenzie, D.: Further Observations on Spreading Osteomyelitis of Skull, J. Laryng. & Otol. **42**:293-308 (May) 1927.

13. Van Alyea, O. E.: Frontal Cells: Anatomic Study, Arch. Otolaryng. **34**:11-23 (July) 1941.

membrane which carry infections into the bone are continuous with those entering the dura, the brain and the blood sinuses.

ETIOLOGIC FACTORS

It appears that the most common causative factor of frontal sinusitis is infection of the upper respiratory tract; in 47 of the 68 cases studied this was true. In 1 case frontal sinusitis followed measles; in 1, "flu." In 2 cases it resulted from angina; in 1 case, from allergy. In 7 cases it resulted from swimming, and in 8 cases the cause was undetermined, as no clear history was available.

Van Alyea[13] brought up the subject of frontal cells and the question whether they should be considered in determining the cause of frontal sinusitis. He concluded:

> Considerable confusion exists concerning the classification of minor cells in the frontal area. The term "frontal cells" is regarded as a fitting title for these cavities because typographically, clinically and, in many instances, genetically they are more frontal than ethmoidal; yet they should not be confused with the major cavity of the frontal bone, the frontal sinus.

They occur with sufficient frequency to justify consideration of their presence as a possible entity in any study of the frontal sinus.

Frontal cells impinging on the frontal sinus appear in some form or other in approximately 50 per cent of all persons, and in one third of these the invasion is in the neighborhood of the ostium of the frontal sinus. Such cells can unquestionably interfere in the drainage of the sinus.

BACTERIOLOGIC FINDINGS

Staphylococcus aureus appears to be the predominating organism found in the cases of frontal sinusitis studied, as recorded in the table.

SYMPTOMS

Usually there is a history of a cold or there is a history of an onset of symptoms occurring two to five days after swimming. Prominent symptoms are nasal stoppage and pain and tenderness over the frontal area. Local packs of heat or cold and nasal shrinkage may quickly abort the disease. However, the pain over the frontal sinus may become more intense, and swelling may occur, indicating a periosteal involvement. The temperature is usually not high, but if it is, one can expect real complications. Pitting edema may occur over the frontal bone, extending to the hair line. It is quite definite then that the patient has osteomyelitis. Increased headache and rise of temperature indicate meningitis, epidural abscess, subdural abscess or brain abscess. Localized convulsions and paresis or paralysis may occur. Vomiting and other signs of intracranial pressure appear. Delirium and death finally supervene.

DIAGNOSIS

The cardinal points in the diagnosis of acute frontal sinusitis are a history of a cold or of swimming, of pain and tenderness over the frontal area and of nasal stoppage. Edema over the frontal area indicates local osteomyelitis of the frontal bone. One cannot rely too much on roentgen findings, particularly in the early stages. It is more usual to see all the sinuses on the affected side cloudy. Mosher [6] stated that the pathologic process in the frontal bone is usually ten days in advance of roentgen findings. When a frontonasal duct becomes blocked either completely or partially, with the mucous membrane of the sinus thickened and secretions retained, it is surprising how little increase there is in density over normal on roentgen examination. Often the difference in density between the two frontal sinuses is so slight, even when one is completely filled, that one must depend on other means of diagnosis.

The signs of progress of an acute infection of the frontal sinus which must be watched for are a change in density, a loss in the outline of the sinus and a reaction in surrounding bone. In a case of severe acute infection in which frontal headache is accompanied by swelling and edema of the tissues over the outline of the sinus but sharply limited to the area of the infected sinus, a constant watch should be maintained for minute perforations of the anterior wall. These perforations are caused by enlargement of the thrombosed small penetrating vessels coming through the bone from the infected mucous membrane. These minute perforations are the early signs of bone infection. Localized loss of outline due to actual necrosis of the wall at one point is an important accompanying finding. Infection has been present at least one week when these signs become evident.

Intracranial complications are suggested by convulsions, deep headache, vomiting and rigidity of the neck. The pressure of the spinal fluid is increased, the optic disks show choking, and delirium and high temperature indicate the terminal stage of the disease.

TREATMENT

In the early stages of acute frontal sinusitis heat or cold applied to the frontal area and intensive shrinkage may abort the disease. It is wise to investigate the maxillary antrum on the affected side and even the sphenoid sinus if necessary, as pansinusitis is usually present when a frontal sinus is infected. Irrigation, particularly of the antrum, aids in decongesting the swollen mucous membrane and allows for freer drainage. In selected cases irrigation of the frontal sinus may be attempted. Sulfadiazine or some other sulfonamide drug should be given in adequate doses to maintain a sufficiently high blood level of the drug. Penicillin should be given in doses of 10 to 30,000 units every three hours.

Should pain and tenderness persist, one should not hesitate to trephine the bone at Ewing's point, thereby establishing immediate and adequate drainage. It has been shown in cases seen at the Los Angeles County General Hospital that prompt trephining is responsible for saving the patient from complications. Also prompt trephining may save many patients from chronic disease of the frontal sinus.

If after trephining there are headache and rise of temperature, one should immediately reopen the trephined area, enlarge it sufficiently to expose the inner table and make an opening through this table to uncover a possible epidural or subdural abscess. Roentgen evidence of bone extension should be followed carefully. It has been pointed out that the actual pathologic change present is at least ten days in advance of the roentgen findings. Spreading edema is evidence of osteomyelitis, and if penicillin and sulfonamide drugs do not stop the progress of this complication, heroic measures should be instituted at once. Mosher advocated removal of the frontal bone at least 1 inch (2.5 cm.) beyond the diseased area. In this idea he was strongly supported by Furstenburg [8] and Judd.[14] Sachs opposed such a radical procedure, believing that sequestrums should be removed as they appear. Dixon expressed the belief that a course of conservation should be followed, saying that thrombosis is nature's mechanism for protecting the organism against systemic spread of infection and is not always a fatal or even a bad sign. He said that the physician should stand by and support the patient while the body is fighting the infection and remove sequestrums as they appear. Blair and Brown [5] advocated conservative treatment, instituting early drainage and removal of sequestrums.

Putney [15] stated that at the present time administration of penicillin with adequate surgical treatment offers the most effective means of combating some of the serious and life-endangering complications of frontal sinusitis. He reported 5 cases in which osteomyelitis of the frontal bone was treated with a surgical procedure plus penicillin therapy.

CONCLUSION

Frontal sinusitis is a serious disease and may be accompanied by many complications, notably osteomyelitis. Fortunately, the disease is not common. Of more than 50,000 patients seen in the outpatient department of the Los Angeles General Hospital because of diseases of ear, nose and throat, only 68 had frontal sinusitis requiring that they be hospitalized, and in only 6 of these did osteomyelitis develop.

14. Mosher, H. P., and Judd, D. K.: An Analysis of Seven Cases of Osteomyelitis of the Frontal Bone as a Complication of Frontal Sinusitis, Laryngoscope **43**:153-212 (March) 1944.

15. Putney, F. J.: Uses of Penicillin in Diseases of Nose and Throat, J. A. M. A. **126**:620-621 (Nov. 4) 1944.

The pathologic aspect of the disease and its treatment are reviewed, and 2 cases are reported.

REPORT OF CASES

CASE 1.—A white man aged 38 came to my office complaining of pain and swelling over the left eye with nausea and fever of three days duration, following a cold which he had had for two weeks. Twenty years before this he had had a submucous resection for nasal difficulty and had had one or two polypectomies in the last ten years. He was admitted to the hospital, where the frontal bone was trephined, with evacuation of a drachm (3.5 cc.) or more of pus. He improved and was dismissed from the hospital on the third day. Three days later he again complained of pain over the left frontal area. The blood count showed 14,000 leukocytes, 78 per cent of which were polymorphonuclear. The trephine opening was still discharging, and the left eye was swollen shut. He was again admitted to the hospital, and the former incision was lengthened; there was an enormous amount of pus from the subperiosteal area and also, from a separate abscess, from the orbit. There was cavitation subperiosteally for three or four inches (7.5 to 10 cm.) temporally. Probing revealed no break in the walls of the frontal cavity. A drain was inserted into the cavity and into the frontal sinus. For one week there was apparently no change in his condition; then suddenly swelling appeared over the right frontal area. The frontal bone was trephined, and the septum which separates the two frontal sinuses was lowered. There appeared to be some improvement, and the temperature remained practically normal except for one or two days, when

Fig. 2 (case 1).—Extensive osteomyelitis complicating frontal sinusitis.

it rose to 101 F. During this time the patient was given adequate doses of sulfadiazine. During the third week, when the patient's condition did not improve, it was decided to remove the frontal bone. At the request of the patient's wife, two other rhinologists were called in consultation. The decision to remove the frontal bone was deferred. At the beginning of the fourth week the patient had weakness of the whole left side. There were also incontinence and projectile vomiting. The eyegrounds showed choked disks. A neurologic consultation was called, and an abscess involving the right frontal lobe of the brain was diagnosed. The patient became stuporous. Autopsy revealed bilateral suppurative frontal sinusitis with abscess of the right frontal lobe, osteomyelitis of the frontal bone and osteomyelitis of both the malar and the temporal bones.

CASE 2.—A white girl aged 16 entered the Alhambra hospital, Jan. 6, 1945, in labor. She had a slight cold on admittance and the following day complained of pain over the right frontal area. On January 8 her temperature began to rise and reached 104 F. on January 10. At that time there were tenderness and slight swelling over the right frontal area. There was no appreciable discharge coming from either nostril, but there was exquisite tenderness at Ewing's point. The right maxillary and frontal sinuses were cloudy on transillumination. The left maxillary and frontal sinuses were clear, and the ears and the throat disclosed no abnormality. Roentgen examination revealed pansinusitis of the right side. The blood count showed 15,000 leukocytes, 80 per cent of which were polymorphonuclear. The red cell count was 5,700,000 and the hemoglobin content 85 per cent. The urine was normal. On January 14 the right antrum was irrigated and a quantity of pus was returned. The same afternoon the right frontal sinus was trephined, and pus under pressure was obtained. No growth was found on culture of the pus. The patient's temperature continued to run from 99 to 103 F. daily for several days, and on January 22 there occurred a definite chill. Headache was severe. Blood cultures were negative. The following day the trephine wound was reopened, and the posterior wall of the sinus was examined. No erosion was evident, but the wall was penetrated to discover pus, if present. No pus was encountered. Penicillin therapy was started January 14 at the time of the trephining. The dosage was maintained at 20,000 units every three hours. Fifteen grains (0.97 Gm.) of sulfadiazine was also given every four hours until a low white cell count led to discontinuance of the use of this drug. At that time roentgen examination revealed a path of rarefaction passing along a diploic vascular channel. The appearance was suggestive of osteomyelitis. Coincidently a localized swelling occurred at the hair line which when opened yielded several cubic centimeters of pus. Permission to remove the right frontal bone was sought but was refused. The spinal fluid pressure was 330 mm. of water, with the Pandy test negative, and no cells were observed. The fields of vision were normal. There was choking of both disks. A neurologic consultation was obtained, and a diagnosis of brain abscess was made. On January 25 the patient was unable to move the fingers of the left hand, and there was violent jerking of the left arm. On January 27 some paralysis of the left side of the face was observed. Later in the day the left leg became paralyzed. On February 10 the cranium was opened and a search made for an abscess of the brain. No abscess was encountered. The dura was red and many times thickened. The cerebral vessels were engorged. The patient was given 35,000 units of penicillin every three hours. For ten days prior to the craniotomy and thereafter the temperature was normal, but headache and vomiting continued. Gradually the paralysis subsided. The headaches improved, and the patient was discharged on March 10. A total of 3,000,000 units of penicillin was used.

Case Reports

SOLITARY NEUROFIBROMA OF THE LARYNX

KENNETH S. OLIVER, M.D.
ALFRED E. DIAB, M.D.
AND
CAESAR N. ABU-JAUDEH, M.D.
BEIRUT, LEBANESE REPUBLIC

NEUROFIBROMA of the larynx is extremely rare. Smith,[1] describing 3 cases in 1944, noted only 12 previously reported similar cases. Five of these were recorded in American literature and 7 in foreign publications. The aim of this paper is to report another case of solitary neurofibroma of the larynx. The patient was the only one with a tumor of this type ever observed and treated by us in the department of otorhinolaryngology of the American University Hospital.

REPORT OF A CASE

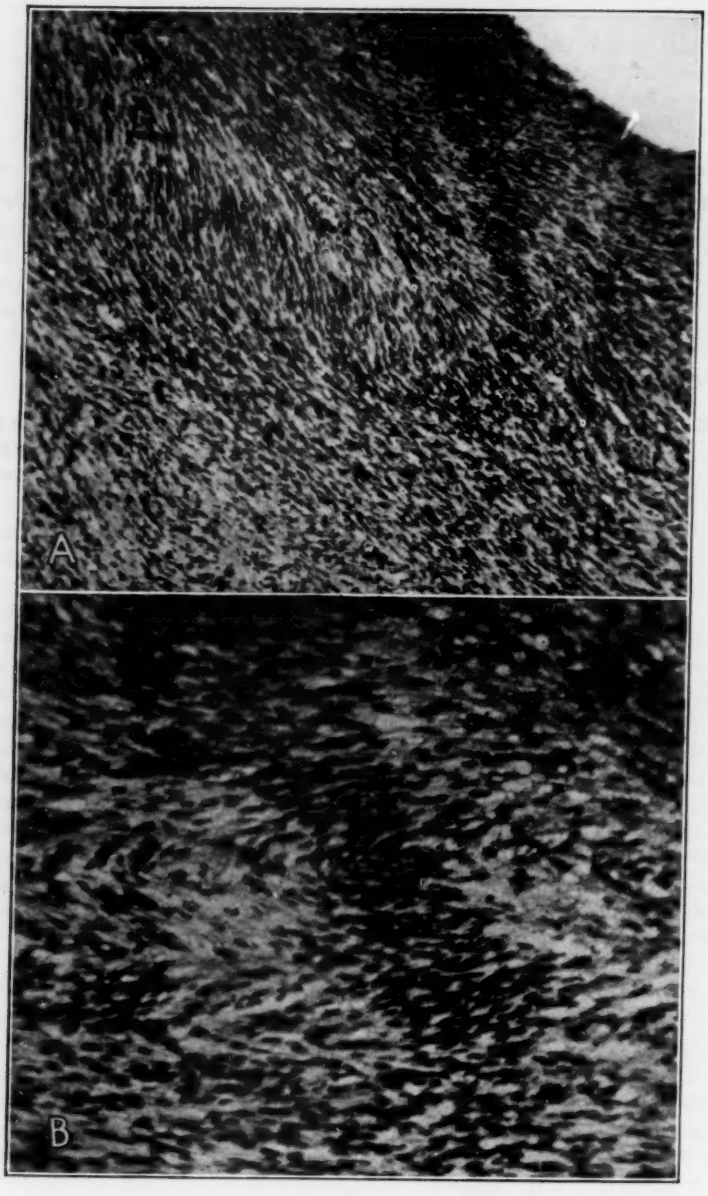
B. S. Z., a 45 year old unmarried woman, was admitted to the hospital on Feb. 10, 1944, complaining of hoarseness, mild stridor and dysphagia of twelve months' duration. These symptoms were gradually becoming more marked. The past history and the history of the family were noncontributory.

Physical examination revealed a well developed and nourished woman with moderately marked hoarseness and stridor. Indirect mirror laryngoscopy showed a grayish silvery smooth rounded tumor occupying the right side of the larynx and obscuring the right vocal cord. The tumor encroached on the glottic chink, producing mild obstruction. On February 15, after preliminary tracheotomy, biopsy was attempted by indirect mirror laryngoscopy. An adequate specimen could not be removed, however, owing to the hard consistency of the tumor, and the pathologist's report was inconclusive. On March 3, therefore, the patient was subjected to direct laryngoscopy under general anesthesia induced by insufflation of ether, and the tumor, which was found to arise from the right aryepiglottic fold, removed by the extratubal method. The tumor was rounded, smooth and encapsulated, and measured about 2 cm. in diameter. It was not adherent to the surrounding tissues. There was immediate relief from dyspnea, and the voice gradually returned to normal. The patient was decannulated ten days after removal of the tumor. Indirect laryngoscopy twenty-two months later revealed a normal right aryepiglottic fold, with normal motility of the right vocal cord and a normal laryngeal lumen. There were no signs of recurrence.

The histologic diagnosis of neurofibroma was made by Dr. Philip Sahyoun. Dr. Bernard Kalfayan made the photomicrographs and the pathologic report, which follows: "The surface of the tumor is partly ulcerated and necrotic and partly covered by mucous membrane. The lamina propria of the existing mucosa is heavily infiltrated by leukocytes and is strikingly vascular and hemorrhagic. The neoplasm is a cellular connective tissue tumor. Its cells are spindle shaped and for the most part arranged irregularly and are found on a collagen-like matrix.

From the American University Hospital.

1. Smith, T. T.: Solitary Neurofibroma of the Larynx, Arch. Otolaryng. 39:144 (Feb.) 1944.



A, photomicrograph of the tumor (× 110); *B*, palisading of cells of the tumor (× 220).

Here and there interlacing bundles are seen, and elsewhere elongated nuclei are arranged parallel to each other like a palisade (figure)."

SUMMARY

This case of neurofibroma of the larynx corroborates findings made by other observers:

1. The symptoms of neurofibroma of the larynx conform to those of any slowly growing noncancerous tumor.

2. The laryngoscopic appearance of the tumor is not characteristic.

3. The usual site of origin is in the area of the ventricular band and the aryepiglottic fold.

4. The removing of tissue for biopsy is difficult on account of the hard consistency of the tumor.

5. Surgical excision is the treatment of choice.

PYLORIC OBSTRUCTION AND STRICTURE OF THE ESOPHAGUS FOLLOWING INGESTION OF LYE (SODIUM HYDROXIDE MIXED WITH SODIUM CARBONATE)

DONALD S. BOLSTAD, M.D.
DETROIT

TWO CASES of pyloric obstruction associated with stricture of the esophagus following ingestion of lye aroused interest in the coexistence of these two lesions resulting from such trauma.

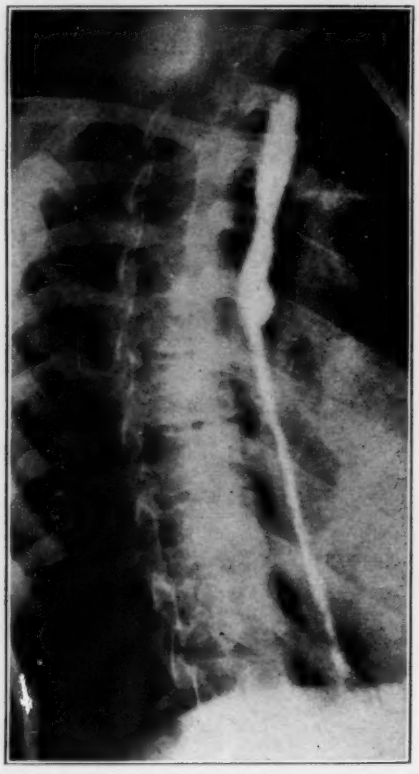


Fig. 1 (case 1).—Roentgenogram showing marked narrowing of the lower half of the esophagus.

Although medical literature makes frequent reference to esophageal stricture following ingestion of lye and to pyloric obstruction following ingestion of acids, the finding that the two lesions have occurred in the same patient as a result of ingestion of either of these two caustic agents apparently is uncommon. Particularly is it difficult to find the two lesions mentioned as following ingestion of lye.

From the Division of Otolaryngology, Henry Ford Hospital.

A careful search of the American literature of the last twenty-five years reveals only 1 case, reported by Vinson and Hartman,[1] of esophageal stricture and pyloric obstruction resulting from ingestion of lye. In 1 other case, reported by Boikan and Singer,[2] pyloric obstruction followed ingestion of lye, but there was no stricture of the esophagus, as proved later by postmortem examination. Heindl,[3] of Vienna, Austria, however, reported a series of 116 cases in which esophageal stricture was caused by ingestion of lye, in 20 per cent of which pyloric obstruction was observed as well. Whether the association of the two lesions is more common in Europe than in this country is not known, but the

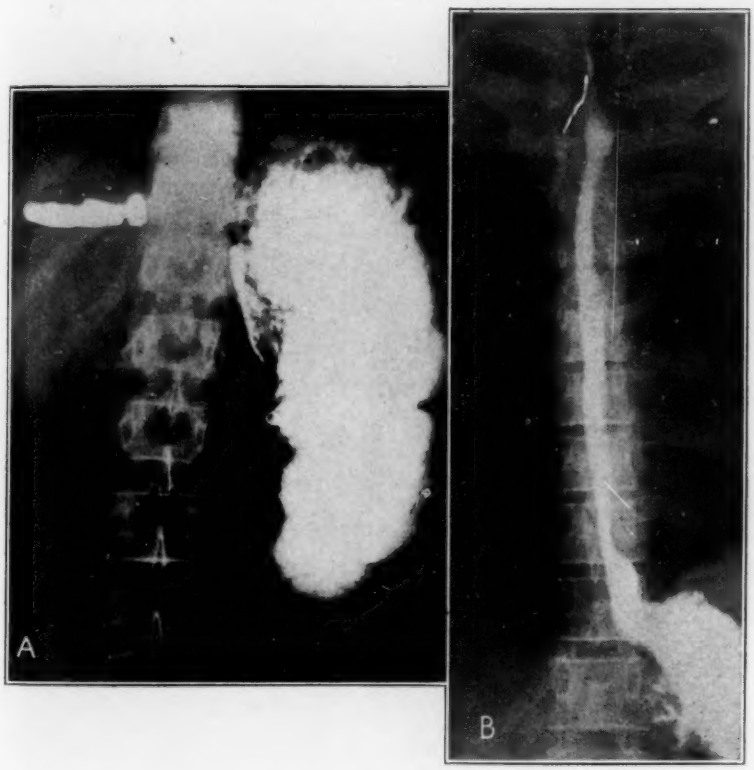


Fig. 2 (case 1).—*A*, five hour retention in the stomach (a pinchcock is on the gastrostomy tube). *B*, improvement of the esophageal stricture following dilatations.

1. Vinson, P. P., and Hartman, H. R.: Pyloric Obstruction Due to Swallowing a Solution of Concentrated Lye, M. Clin. North America **8**:1037 (Jan.), 1925.

2. Boikan, W. S., and Singer, H. A.: Gastric Sequelae of Corrosive Poisoning, Arch. Int. Med. **46**:342 (Aug.) 1930.

3. Heindl, A., Jr.: Klinische Beobachtungen auf 137 gutartigen Oesophagusstenosen der I. chirurgische Universitätsklinik Wien, 1901-1925, Deutsche Ztschr. f. Chir. **199**:252 (Nov. 1) 1926.

paucity of such reports in the American literature would suggest that such is the case. One can only conjecture as to the cause of this discrepancy of reports, and the establishment of this cause is not the purpose of this paper.

In both the cases observed in this clinic the patient was a woman who ingested lye with suicidal intent. In each instance the pyloric obstruction, apparently complete, occurred within a relatively short period. Gastroenterostomy, the procedure of choice for such pyloric obstruction, was done in both cases, controlling the symptoms of pyloric obstruction satisfactorily. Esophageal dilatations were also necessary in both.

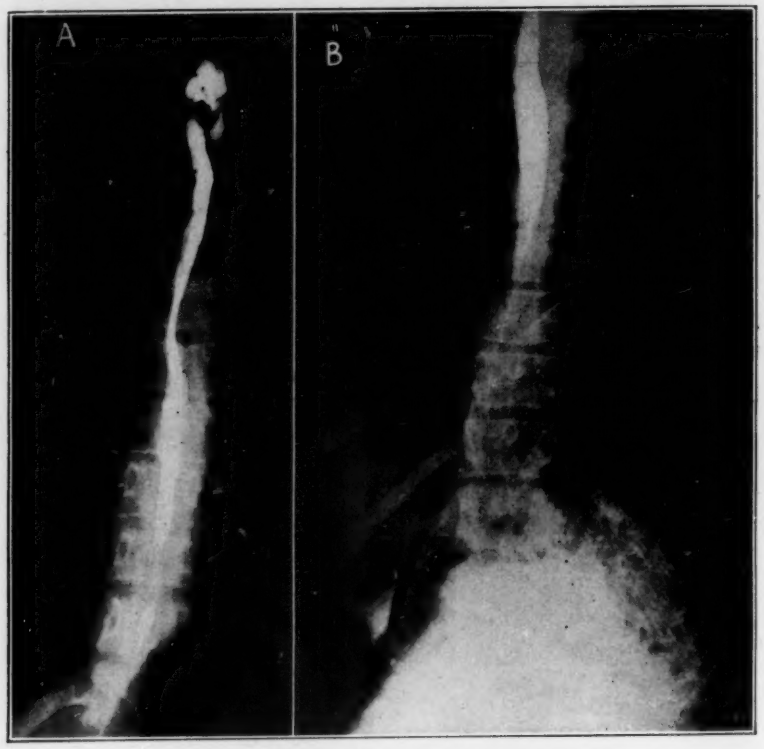


Fig. 3 (case 2).—*A*, degree of esophageal obstruction present. *B*, marked dilatation of the stomach with complete retention (retouched photograph).

REPORT OF CASE

CASE 1.—E. M., a 32 year old white woman was admitted, Feb. 24, 1944, to the neuropsychiatric service of Henry Ford Hospital by transfer from a city hospital with an acute mental disorder. Fifteen days prior to admission she had swallowed a quantity of lye solution in an attempt at suicide. The acute symptoms of esophageal irritation had subsided, but she refused anything but a liquid diet. About six days after admission she suddenly became unable to swallow liquids. She was seen in consultation, and roentgenograms of the esophagus were requested. As shown in figure 1, a marked stricture of the lower half of the esophagus was

present. Esophageal dilatations were advised, but she was unable to swallow a string. On March 16 esophagoscopy showed the esophagus to be normal in the upper half, with a marked stricture below this level. A no. 10 bougie could be passed to the cardia but could not be passed through the cardia into the stomach. On March 21 local anesthesia was induced, and gastrostomy was performed. While the interior of the stomach was exposed, an esophagoscope was introduced, through which a no. 8 bougie was passed into the stomach, with guidance from below. A twisted silk string was then attached to the bougie, and the bougie was withdrawn into the mouth. Several esophageal dilators were passed over the string into the stomach. The lower end of the string was left hanging out on the abdomen

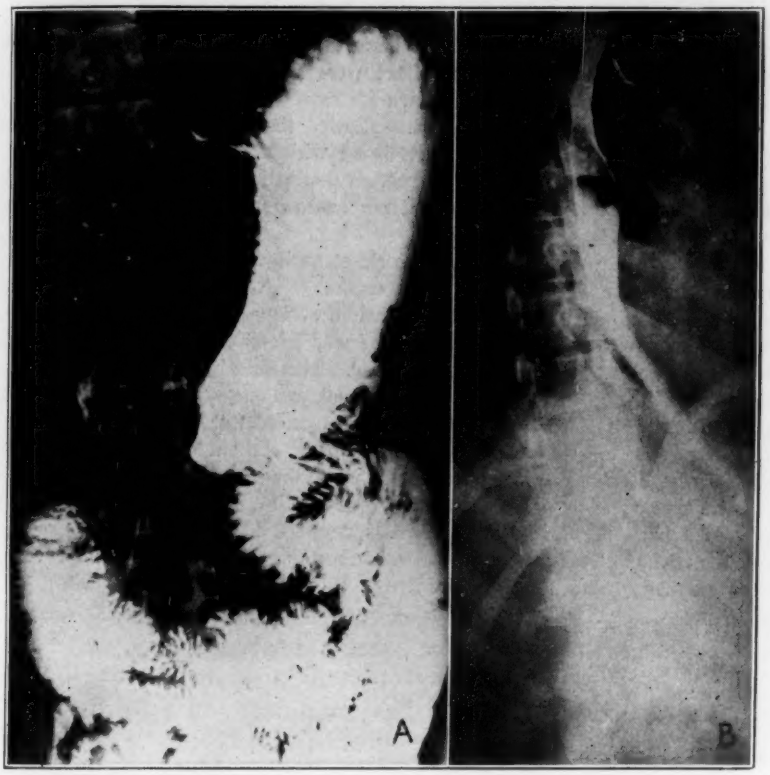


Fig. 4 (case 2).—*A*, functioning gastroenterostomy. *B*, improvement of esophageal stricture following dilatations.

through the gastrostomy opening. Dilatations were done on several occasions until the esophagus had been dilated to the extent that bougie 35F could be used, with the patient swallowing liquids and semisolids well.

On April 15, the patient began to vomit, and large amounts of partially digested food poured out of the gastrostoma. A barium sulfate meal showed complete obstruction of the pylorus (fig. 2*A*), and gastroenterostomy was performed on April 21. The gastrostoma was closed at this time. Further dilatations were delayed for two weeks to insure adequate healing of the operative site, and, following this, the patient was unable to swallow a string. Esophagoscopy was performed on May 8, at which time several bougies were passed into the stomach

and a string was left in the stomach. Further dilatations were then done without event, and the patient left the hospital on May 29, swallowing food normally and gaining weight (fig. 2*B*). She returned at intervals to the outpatient department for further dilatations, and by October 19 the esophagus had been dilated to 37F.

About a month later, November 16, the patient returned, again unable to swallow the string and in acute mental disturbance. She was transferred to a hospital for mental diseases and her further progress is not known. It was reported that she died several weeks after her admission.

CASE 2.—B. S., a 26 year old Negro woman, was admitted to the outpatient department on June 20, 1946, with a history of having swallowed a quantity of "drano" (sodium hydroxide) solution. During the three weeks prior to her admission she had lost 30 pounds (13.5 Kg.) and had noted increasing difficulty in "keeping anything on the stomach." Unfortunately, fluoroscopic and roentgen examinations of the gastrointestinal tract were not made, and the patient was instructed to swallow a string and return for esophageal dilatation. She returned on three occasions, each time having swallowed the string. Attempts to draw the string taut, however, resulted in its being withdrawn without resistance each time. On July 2 fluoroscopic and roentgen examination showed tremendous dilatation of the stomach with only moderate narrowing of the lower end of the esophagus (fig. 3).

By this time it was evident that pyloric stenosis was present, and the patient was admitted to the hospital for gastroenterostomy. A Levine tube was introduced into the stomach, and large amounts of barium sulfate and partially digested food were aspirated from the stomach. The tube was left in place, and continuous suction was employed to restore normal tonicity. The fluid balance and the chemical composition of the blood were restored to normal, and on July 22 gastroenterostomy was performed. The postoperative course was uneventful, and on August 6 the patient was able to swallow a twisted silk string without difficulty. Subsequent dilatations have proceeded without incident up to the time of writing, and the size of bougie that could be passed has progressed to 45F. The patient eats normally, has gained back her lost weight and has resumed her work. Roentgenograms show a satisfactorily functioning gastroenterostoma (fig. 4*A*) and improvement of the esophageal strictures (fig. 4*B*).

RADIUM TREATMENT OF CANCER OF ORBIT AND ETHMOID CELLS

M. ONSI ABDEEN, M.R.C.S. (England), D.L.O. R.C.S. & P. (England)
Professor and Chief of the Ear, Nose and Throat Department, University Hospitals
ALEXANDRIA, EGYPT

IN PRESENTING this case I do not profess to have cured the cancer, cancer being up to the present a destructive, mutilating, incurable and deadly disease if not seen early.

Surgical excision and radiation, alone or combined, are used for its treatment, but in most cases the end results are the same. Sooner or later the primary lesion or the secondary metastases or both reappear and end the scene.

Helplessness to cure cancer will remain in my opinion till a new medicine, a vaccine or a serum is discovered which will eradicate the visible primary and the invisible secondary lesions.

I use the term "invisible secondary lesions" because I still remember a patient with cancer of the larynx on whom I performed complete laryngectomy some years ago and hoped that I had succeeded in curing the cancer.

At the time of the operation the patient did not have any visible or palpable glands in the neck. A year and a half after the operation a secondary involvement of the glands of the neck and the mediastinum had developed, which killed him. There was no laryngeal recurrence.

Had a drug been available, the visible primary and the invisible secondary lesions of the glands would have been cured by it and no secondary lesions would have appeared later.

The absence of this sought for drug should not stop one from treating these unfortunate patients by the means in one's hands to alleviate their miseries, even when the condition is far advanced.

The case to be reported illustrates this clearly. The condition was so advanced that on the basis of appearance one would not think it possible to do anything for the patient. Looking at the photographs taken before and after treatment, one sees the striking difference and the result accomplished by a device for using a very small amount of radium plus perseverence and patience.

REPORT OF A CASE

M. M. K., a man aged 30, was admitted to the hospital on Oct. 15, 1940 with a foul-smelling fungating mass at the site of the left orbit, extending beyond the middle line near the inner canthus of the right eye. The mass extended upward

to the hair line on the left side of the forehead, downward to the level of the upper lip, closing the left nostril, and backward to a point midway between the outer canthus and the tragus of the left ear. The inside of the nose was full of a friable mass.

The left preauricular and submaxillary lymph nodes were enlarged and hard. Figure 1 gives the exact appearance of the patient as seen on admission.

A piece was removed from the fungating mass for pathologic examination.

Fig. 1.—Patient as he appeared on admission, Oct. 16, 1940.

Fig. 2.—Diagram of cradle with radium tubes hung in the dome.

The report was: "The growth is that of an alveolar carcinoma, probably arising from one of the salivary or lacrimal glands."

Technic of Treatment.—A radium bomb would have been ideal for such a huge mass, to give homogeneous radiation, but unfortunately that was not available. The largest amount of radium we have in the University Hospital is two tubes of 50 mg. each.

To put two 50 mg. tubes in the center of the mass would burn the center and stimulate the periphery.

To avoid this I devised a cradle 6 cm. in diameter made of iron wire, similar to an anesthesia mask. The two radium tubes were hung in the dome of the cradle as illustrated in figure 2. The distance from the tubes to the surface of the tumor was 3 cm. The cradle was covered with a lead sheet to prevent the radiation from going beyond its circumference.

Fig. 3.—Reduction of cancer on Nov. 19, 1940, after one month's irradiation (upper photographs) and about two weeks later, on Nov. 20, 1940 (lower photographs).

By placing the radium thus at a distance from the surface, the radiation was distributed almost evenly to the area limited by the circumference of the cradle.

The area of the tumor was divided into segments, each the size of the circumference of the cradle.

The appliance was placed on one segment of the tumor and left, fixed with a bandage, for twenty-four hours; then it was moved to another segment and left for the same time, and so on until the whole tumor had been irradiated.

This technic was repeated again and again in the same manner (with slight differences in time of exposure according to the reaction) until the mass disappeared, without causing any severe reaction of the surrounding healthy tissue except slight erythema, never a burn.

Sometimes the treatment was interrupted because the radium was needed for the treatment of other patients.

The whole treatment took thirty-seven days of exposures.

Fig. 4.—Appearance of patient when discharged, March 31, 1941.

At the same time five needles, each containing 2 mg. of radium, were put into the left nostril in the ethmoid region for seven days.

Any one who has enough radium at hand would say, "What a waste of time!" But one, like myself, who has only a very limited amount of radium, must have enough patience to relieve his patient.

Five months after admission the patient left the hospital to all appearances cured, as shown in figure 4. He emigrated to the country because of the air raids.

I was in touch with the patient for a year without observing any recurrences and then lost sight of him. Again, one should use patience and all means in one's hands to alleviate the pains and miseries of the patient till the time comes that a curative drug is discovered.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

SAMUEL SALINGER, M.D.
CHICAGO

(Continued from page 102)

SURGICAL TREATMENT

MOSHER [82] reviews his experience with surgical treatment of the frontal sinus over a considerable period and offers some constructive observations. He still adheres to the aphorism "respect the virginity of the nasofrontal duct or take the consequences," which he coined some years ago, and points out the failures which have been so widely registered as a result of violating this dictum. The experiments of Walsh in this connection add weight to the clinical evidence that after ruthless destruction of this passageway neither skin graft nor mucosal flap restores its patency sufficiently to insure permanency.

Mosher adds his approval to those who have been advocating the trephine opening of the floor of the sinus in severe acute disease in which the duct becomes completely occluded and the symptoms suggest the likelihood of a progressive infection with the possibility of impending complications.

The various radical procedures come in for critical review. Their inadequacies and shortcomings are analyzed, and it is clear that the author is not completely satisfied. He suggests an obliterating operation in which the floor of the sinus is left intact but both walls are removed, so that the skin may be pressed into contact with the dura, to which it should adhere. He believes that the operation is feasible in view of the advances of plastic surgery which make it possible to overcome the resulting deformity through a secondary implantation of tantalum, bone or other substance described in the literature.

He again brings out the essential features of osteomyelitis, emphasizing the diagnostic feature of pitting edema, the lateness of roentgenologic confirmation, the importance of the veins of the diploe as transmitters of the infection and the role of chemotherapy in assisting nature to localize the process, thus making subsequent surgical treatment more likely to succeed. He emphasizes the importance and the necessity of continuing chemotherapy for a long enough period to forestall the recurrence which inevitably follows, also the importance of applying a radi-

82. Mosher, H. P.: My Milestones, Laryngoscope **56**:639 (Nov.) 1946.

cal surgical procedure when destruction of bone has been definitely established.

Weille [83] presents an analysis of the results of surgical treatment of the frontal sinus taken over a period of fifteen years, in 276 cases. In 95 cases there had been more than one operation on one or both frontal sinuses. In 71 cases in which an obliterating operation was done, plastic repair was required. There were 96 cases of osteomyelitis requiring multiple operations; the total mortality in this group was 23. Of the 176 patients with nonosteomyelitic disease, only 52 required multiple operations. One hundred and ninety-one operations of the Lynch type were performed and 123 obliterative operations. Failures of operations of the Lynch type were attributed to adhesions, remnants of the floor of the frontal sinus, residual cells of the ethmoid sinus and growth of new bone, which closed the duct. These factors are all thoroughly discussed, and the various measures that have been suggested for maintaining the patency of the duct are described. The author states that the obliterating operation "is not an unmixed blessing" since 23 of the 123 patients treated this way required further surgical intervention.

It is apparent from this study that the problem is as yet unsolved. Despite antibiotics, a knowledge of surgical anatomy and of the elements of wound repair, and the relief offered through reconstructive plastic surgery, failures are still frequent. The article is an important one, since it points out the deficiencies of the past, explaining the reasons therefor, and shows the lines along which further experimentation must be conducted if an eventually foolproof operation is ever to be realized.

Among the items mentioned by Hoople [84] in his interesting review of his experiences is one pertaining to the maintenance of the nasofrontal passage following radical frontal sinusotomy. He employed a molded acrylic tube surrounded by a skin graft, which was left in place for as long as was necessary to insure patency. In one case it was left in place for three months without ill effects. He found this tube far cleaner than a rubber tube and the procedure more satisfactory.

Brown [85] gives a succinct analysis of the therapy of frontal sinusitis. The indications for trephining the sinus in the presence of an acute infection are persistent pain, fever, increasing edema and failure of the patient to respond to earlier conservative treatment after twenty-four hours. This operation is considered more urgent if the disease follows swimming. The opening is made in the floor of the sinus near its inner angle. After the sinus has been opened and the pus allowed to escape,

83. Weille, F. L.: The Problem of Secondary Frontal Sinus Surgery, Tr. Am. Laryng. A. **67**:150, 1946.

84. Hoople, G. D.: An Otolaryngologist's Experience in World War II, Ann. Otol., Rhin. & Laryng. **55**:121 (March) 1946.

85. Brown, J. M.: Frontal Sinusitis, Laryngoscope **56**:116 (March) 1946.

a small rubber tube is inserted. No further manipulation is advisable. Irrigation may be practiced after several days. If the fluid fails to escape into the nose, a Van Alyea cannula may be passed. If this fails, a submucous resection may be required, and frequently the removal of a few anterior ethmoid cells to facilitate passage of the irrigating cannula. Penicillin is used throughout.

The author touches briefly on the various complications of frontal sinusitis, offering some practical hints by way of therapy.

Jesberg [86] states that the external approach is the proper one for the eradication of chronic frontal sinusitis. The diseased lining must be removed and either the cavity ablated or provision made for permanent ventilation and drainage. He uses the Jansen-Lynch incision, opens the sinus in the oculofrontal angle, and removes as much of the lacrimal bone, os planum and ascending process of the superior maxilla as is necessary for good visualization of the interior of the sinus. Adequate drainage is obtained by removing the upper part of the septum. Attention is called to the necessity of obliterating all angles and pockets. If the sinus is large or extends laterally, he advises that an incision be made through the brow with adequate exposure. If necessary, the external plate must be removed to prevent overhang. The cosmetic result should not deter one from thoroughly exenterating the diseased sinus, and since an adequate and permanent nasofrontal duct is provided, one may expect a permanent cure.

Hernández [87] states three conditions which are necessary for a successful frontal sinusotomy: (1) thorough exenteration of the anterior ethmoid cells; (2) adequate visualization of the frontal sinus to permit removal of all diseased tissue; (3) a permanent wide nasofrontal passage. He presents several illustrations showing the method followed by Professor Tato in forming a mucosal flap which covers the denuded bone and exposed periorbita. This flap is similar to the one described by Bárány. It is derived partly from the septum and partly from the preturbinal region; it is split into two triangular segments, one posterointernal, which is to cover the internal aspect of the nasofrontal opening, and the other interoexternal, which is reflected against the periorbita.

Jørgensen and Melgaard [88] recommend puncture of the frontal sinus according to the method described by K. Beck.[89] A hole is bored directly through the anterior wall with either an electrically driven burr

86. Jesberg, S.: Surgical Treatment of Chronic Frontal Sinusitis, Arch. Otolaryng. **43**:66 (Jan.) 1946.

87. Hernández, A.: Cirurgia del frontal, Prensa méd. argent. **32**:2482 (Dec. 14) 1945.

88. Jørgensen, A., and Melgaard, K. R.: Behandlung von Sinusitis frontalis mit Punktion ad mod. Beck, Acta oto-laryng **33**:36, 1945.

89. Beck, K.: Ueber die Behandlung von Stirnhöhlenentzündungen durch Dränage von aussen, Ztschr. f. Laryng., Rhin., Otol. **24**:369, 1933.

or a hand borer, after the depth of the sinus has been previously determined by roentgenograms. When the bone has been perforated, the mucosa is penetrated with a sharp trocar and a cannula introduced, which is fixed to a metal plate held in place by adhesive tape. This permits release of secretions and the introduction of medicaments as indicated. The authors report 7 cases in which this procedure was followed out with good results. It was especially effective in cases of acute sinusitis with pain and fever when intranasal measures short of surgical intervention failed to relieve the condition.

Lindeman [90] compares the results of the Caldwell-Luc operation with those that followed a wide intranasal antrostomy and finds that the percentage of cures was the same in both groups. There were 110 patients, of whom 36 were treated by antrostomy, 64 by the Caldwell-Luc operation and 10 by a combination of both. Of those treated by antrostomy, 55 per cent were cured, 28 per cent improved and 17 per cent unchanged. Of those treated by the Caldwell-Luc procedure, 59 per cent were cured, 27 per cent improved and 14 per cent unchanged.

Moulonguet [91] claims that he observed good results with use of a mucous membrane graft to maintain the patency of the nasofrontal duct after the external operation. The graft, measuring 2 by 3 cm., is taken from the inner surface of the lower lip and immediately applied to the posterior wall of the enlarged duct. It is held in place by a gauze pack wrapped in gutta percha, which is left in place for one week. This pressure plug is cup shaped, with the dome directed toward the sinus and the open end toward the nasal cavity.

Morales [92] discusses at length the various phases of chronic suppuration of the frontal sinuses with fistulization. He reproduces Portman's illustrations of the external operation, following the Ogston-Luc technic. He advocates removal of the middle turbinate and exenteration of anterior ethmoid cells, a procedure that provides a wide opening to facilitate drainage, and he uses iodoform gauze packing, which is left in situ up to ten days. He believes that healing is encouraged if iodides are administered to the patient during the postoperative period. The article is a lengthy one, with many illustrations.

Dixon [93] has had excellent results in the treatment of hyperplastic ethmoiditis with polypi through intranasal ethmoidectomy. A follow-up

90. Lindeman, H.: En etterundersøgelse av pasienter operert for sinusitis maxillaris, specielt med omsyn til resultatene etter "bred apning" og Lus-Caldwell's operasjon, Nord. med. **31**:1897 (Aug. 23) 1946.

91. Moulonguet, M.: De l'emploi de greffes de muqueuse labiale dans la cure chirurgicale des sinusites frontales, Ann. d'oto-laryng. **12**:501 (Oct.-Dec.) 1945.

92. Morales, P. P.: Las sinusitis frontales supuradas cronicas fistulizadas y su tratamiento quirurgico, Arch. venezol. Soc. de oto-rino-laring., oftal., neurol. **6**:99 (Sept. 30) 1945.

93. Dixon, F. W.: Clinical Results in Patients Treated by Intranasal Ethmoidectomy, Arch. Otolaryng. **43**:59 (Jan.) 1946.

investigation of 125 cases covering a period of three and a half years revealed 96 per cent of the patients satisfied with the operation and declaring themselves comfortable as a result. He contends that even though most patients with this type of ethmoiditis are allergic it is important that they be given relief, whether they are under specific treatment or not. In many cases the cause of the allergy is undetermined, and in others the therapy is sporadic and frequently unsatisfactory. The details of the procedure are outlined and suggestions are given as to proper postoperative care, which includes determination of the prevailing bacteria and administration of penicillin for an average of five days.

Patterson,[94a] in a report to the Laryngological Section of the Royal Society of Medicine, describes again his operation for the exenteration of the ethmoid cells, the maxillary antrum and the sphenoid sinus. (The earlier report was abstracted in one of these reviews.[94b]) Seventy-five operations were performed between December 1939 and March 1945. There were 3 cases of postoperative diplopia and some transient epiphora, in all of which these conditions cleared up. In 3 cases there was recurrence of the polypi, with further surgical treatment being required. In 2 of these cases the polypi were found to have arisen from cells lying anterior to the nasolacrimal duct. The author feels that his technic has yielded him much better results than he ever obtained previously from other procedures.

Dale [95] describes the anesthesia employed in performing Patterson's external operation on the sinuses. General anesthesia is given only in those cases in which the patients "are temperamentally unsuited for regional methods, such as children, adolescents and those with an unstable nervous system." The majority of their patients underwent the operation with a combination of intravenous medication and nerve block. In the first instance the patient receives ⅓ grain (21.5 mg.) of "pantopon" (a mixture of hydrochlorides of opium alkaloids) in 3 cc. of distilled water, given slowly by the intravenous route about one and one-half hours after a preliminary hypodermic injection of ⅓ grain of "pantopon" and 1/150 grain (0.43 mg.) of scopolamine hydrobromide. Locally, the maxillary nerve is blocked via the subzygomatic approach through the incisura of the mandible. Also, the anterior ethmoid nerve is blocked at the foramen in the internal wall of the orbit. The author uses a solution containing procaine hydrochloride 40 mg., tetracaine hydrochloride 2 mg. and epinephrine hydrochloride 1:400,000, put up in 2 cc. ampules.

94. (*a*) Patterson, N.: External Operation on the Nasal Sinuses, J. Laryng. & Otol. **60**:449 (Nov.) 1945. (*b*) Salinger, S.: Progress in Otolaryngology: The Paranasal Sinuses, Arch. Otolaryng. **42**:285 (Oct.) 1945.

95. Dale, H. W. L.: Anesthesia for Surgery of the Nasal Sinuses, J. Laryng. & Otol. **60**:452 (Nov.) 1945.

Winborn [96] reviews the indications for surgical treatment of the sinuses and discusses the pros and cons and the relative merits of intranasal and external approaches. He emphasizes the importance of thoroughness when a radical surgical operation is attempted, since the removal of all diseased tissue and the opening of all remote cells and recesses are prerequisite to a complete cure.

De Rezende [97] reviews the various well known surgical procedures for the cure of chronic sinusitis and expresses his preference for the transantral ethmoidectomy, which he attributes to Ermiro de Lima, and which was so well described by Joas Marimbo at the first Pan-American Congress of Otorhinolaryngology at Buenos Aires, Argentina.

Smeraldi [98] reviews the results of his treatment of various types of sinusitis over a five year period. He discusses the value of the various diagnostic measures usually employed. Nothing new is presented, and the article fails to show the statistics which one would expect from the title.

Haase [99] reviews the results obtained with the Caldwell-Luc operation in 131 cases of maxillary sinusitis and finds that the condition was cured in 54 per cent of the patients, improved in 28 per cent and unaffected in 18 per cent. He claims that these figures are comparable to similar statistics of other authors and attempts to explain the failure to give relief in nearly 20 per cent of the group. In most of these the pathologic condition was complicated. The infection of the maxillary sinus was only one factor. Failure in cases in which polypi were numerous is attributed to an allergic factor which apparently was not taken into account when the operation was performed. The size of the nasoantral opening evidently influenced the result but little, since in the small group in which this was considerable the percentage of failures was no greater than the over-all percentage.

The evaluation of final results was based on amelioration of symptoms, results of lavage and observations made directly by way of the antroscope.

Björk [100] contends that procedures described by Paartsch for the removal of cysts of the upper jaw, practiced for a number of years by oral surgeons, leave much to be desired in many cases. His objections

96. Winborn, C. D.: Major Surgery of the Suppurative Paranasal Sinuses, Texas State J. Med. **42**:434 (Nov.) 1946.

97. de Rezende, M. O.: Tratamento cirurgico das sinusites, Rev. paulista de med. **27**:285 (Oct.) 1945.

98. Smeraldi, R.: Considerazioni clinico statistiche sulle sinusiti facciali e sulla loro cura, Gior. veneto di sc. med. **16**:230 (June) 1942.

99. Haase, L. B.: Exam complémentaire de 131 malades operes selon le procede de Luc-Caldwell, Acta oto-laryng. **34**:23, 1946.

100. Björk, M.: On Rhinological Methods of Operating Large Dental Cysts in the Upper Jaw, Acta oto-laryng. **34**:118, 1946.

are that the cavity resulting in the mouth forms a trap wherein food accumulates and is retained, causing irritation and giving off a foul odor. Except in the cases in which the cyst occupies the external portion of the maxilla, he would substitute intranasal or transcanine procedures designed to bring the cavity into direct relation to the maxillary sinus and the nasal fossa, sealing off the oral side to prevent infection of the mouth. If the cyst is below the floor of the nose, in relation to the incisors, he advocates removing it through the mouth, breaking down the bone that intervenes between the cyst wall and the nasal floor, turning down a mucosal flap to partially line the cavity and then closing the oral incision. If the cyst is in relation to the bicuspid or the molar teeth, he would employ the Caldwell-Luc approach, removing all of the cyst wall except that portion which is directly proximal to the roots of the teeth. The cyst cavity is made to communicate with the antrum, which in turn communicates with the nasal cavity by way of an opening in the inferior meatus. A number of diagrams accompany the article and demonstrate the various technics under discussion.

Molina and Juarez,[101] during a recent five year period, performed the Ermiro de Lima operation on 56 patients with most satisfactory results. As has been explained in previous works, the operation consists of a transmaxillary submucous exenteration of the ethmoid cells and of the sphenoid sinus and enlargement of the nasofrontal passage via the anterior ethmoid cell group. In none of the cases was it necessary to open the frontal sinus externally. The operation is indicated in most cases of chronic pansinusitis and offers the surgeon a means of clearing out all the infected sinuses without making any external incision. In no case, however, did they attempt to operate on both sides at the same sitting. If the nose is filled with polypi, they advise that these growths be removed intranasally before the major procedure is undertaken. Also, they advise that several preliminary irrigations of the antrum be given so as to render the cavity as free from secretions as possible. As for anesthesia, they rely on the placing of tampons saturated with tetracaine hydrochloride in the nose, injection of the canine fossa and blocking of the anterior ethmoid nerve. They have not found it necessary to block the nerves in the pterygomaxillary fossa. They state that the sinuses should be thoroughly cleaned out but that the external walls of the cavity should not be curetted or denuded. They report that when 38 of the patients were reexamined in December 1945 and January 1946 the operative cavities were all healed without residual suppuration, the nasofrontal ducts were permeable and the lining mucosa looked healthy.

101. Molina, R. J., and Juarez, H.: Consideraciones sobre nuestra experiencia con la operación de Ermiro de Lima, Rev. méd. de Córdoba **34**:298 (June) 1946.

Hersh's [102] patient had an alveolar fistula, measuring 13 by 5 mm., in which he had worn an obturator for eleven years. The Kahn test was positive, and material removed from the infected antrum yielded Streptococcus viridans and Hemophilus influenzae on culture. The procedure for closing the fistula was similar to the one proposed by Hill,[103] which was not known to the author at the time. However, the author claims that Hill's method was not applicable in this case because of proximity of teeth to the margin of the fistula as well as the large size of the opening. The procedure employed in the present instance consisted of the raising of a mucoperiosteal flap "from the buccal edge of the alveolar ridge toward the palate and from front to back so that the fistulous opening was incorporated in the flap. As the tissue was raised, as much of the lining of the fistula as possible was separated from the bony edges to remain attached to the flap." A second buccal flap with a broad base was raised and rotated 180 degrees so as to present its epithelial surface toward the fistulous opening, to the margins of which it was sutured. The fistulous opening in the first flap was then trimmed and closed with sutures, after which the flap was pulled over to cover the raw surface of the second flap, previously rotated and sutured.

Proctor [104] suggests closing an alveolar fistula by means of a tightly fitting plug of preserved rib cartilage without any mucous membrane covering flap. If the sinus is infected, it can be cleaned out before the fistula is plugged.

The author promises a more detailed report of the technic and its application in a future contribution.

NONSURGICAL THERAPY

Drugs.—In appraising reports that the antibiotics have been successfully employed in the treatment of rhinitis and sinusitis, it is difficult for the skeptical to be fired by the enthusiasm of many of the authors. That there will be prompt response in cases of acute infection is to be expected, since in most of them recovery will occur spontaneously, irrespective of the medicaments used. Early response in cases of chronic infection is encouraging, but the difficulty lies in the fact that most of the reports end with the primary improvement, leaving the reader with no information as to the subsequent course of the process. All physicians know how chronic diseases are influenced primarily by changes

102. Hersh, J. H.: Plastic Repair of a Large Alveolar-Antral Fistula, Arch. Otolaryng. **43**:141 (Feb.) 1946.

103. Hill, F. T.: Management of Alveolar Fistula, Arch. Otolaryng. **40**:167 (Sept.) 1944.

104. Proctor, B.: The Closure of Oromaxillary Fistulae: A Preliminary Report, Laryngoscope **56**:46 (Feb.) 1946.

of weather and of the general status of the patient and how various standard procedures when methodically applied frequently bring about early improvement. However, they are also aware that many of these conditions are not cured, that the improvement is only temporary and that the patients are prone to relapses and acute exacerbations with intervals of comparative comfort for various periods. To evaluate truly the effectiveness of a drug it is therefore necessary that the patients be observed over at least three or four seasons and that final appraisals of the results include not only the symptomatic findings but also the local findings, including roentgenograms and bacteriologic data.

McMahon [105] discusses the effects of antibiotics, both from the point of view of the reaction of the host and from that of their influence on the bacterial invaders. It has been shown that these drugs are both bacteriostatic and bactericidal but that certain strains of organisms known to be susceptible frequently prove to be resistant to a point where the effectiveness of the agent is reduced to nil. So far as the local use of these drugs is concerned, the author feels that applying them to the surfaces of the nasal or pharyngeal mucosa is ineffectual and often futile, because the bacteria are usually in the subepithelial layers and because the "stream of transudation is to the surface," making it difficult for the medicament to penetrate into the deeper layers. Effective results can be depended on only if the drugs are introduced into the circulation, to be carried to the foci of infection. Frequently their activity is limited by the fact that the inflammatory area is hemmed in by fibrosed tissue with blocked lymphatic channels, which makes it difficult for the solutions to penetrate.

Another difficult matter to evaluate is the well known phenomenon of recession of symptoms followed by recurrence on withdrawal of the drug. This is taken to indicate that the organism is resistant to the drug, its virulence having been only temporarily abated. Before one can set forth definite rules of procedure, it is necessary that more knowledge be available from the fields of immunology, bacteriology, biochemistry and endocrinology. The subject of the role of antibiotics in otolaryngology is far more complex than it seems, and the author feels that the young men preparing to follow the specialty will need more careful instruction and training in the aforenamed basic sciences.

Dickson [106] describes the results of his experiments to determine the local mucosal effects of sulfonamide drugs combined with vasoconstrictors. Fifteen rabbits were used. In one group the various drug combinations were used for five days; in another group, for fifteen days.

---

105. McMahon, B. J.: The Influence of the Sulfonamides and Antibiotics on the Future of Otolaryngology, Ann. Otol., Rhin. & Laryng. **55**:298 (June) 1946.

106. Dickson, J. C.: Effect of Sulfonamide Drugs on Mucous Membranes, Arch. Otolaryng. **44**:474 (Oct.) 1946.

Three rabbits served as controls. After the tests the rabbits were killed, the heads sectioned and the nasal mucosae examined. The p_H values of the drugs as given by the pharmaceutic houses were compared with the author's own determinations; no appreciable differences were noted. The experiments showed that none of the six drug combinations used produced any ill effects on the mucous membranes. The combinations employed were "thizodrin" (sodium sulfathiazole and desoxyephedrine hydrochloride), "sulfadrine," "gluco-fedrin" (ephedrine lactate, 1 per cent, in an isotonic solution of dextrose with chlorbutanol, 0.5 per cent, and menthol) with sulfathiazole, "sulfedex" (a stabilized, buffered solution of: sodium sulfathiazole, 2.5 per cent; d-1-desoxyephedrine, 0.125 per cent; sodium sulfite, 2 per cent), "paredrine"-sulfathiazole suspension (microcrystalline sulfathiazole in an isotonic aqueous medium with "paredrine hydrobromide," 1 per cent) and sulmefrin (sulfathiazole sodium, 2.5 per cent, and d, l-desoxyephedrine hydrochloride, 0.125 per cent, in an isotonic medium). In a control rabbit which had been treated with a 5 per cent solution of sulfathiazole sodium for fifteen days, the mucosa was found necrotic, sloughing away in places, with collections of pus on the surface. Edema, swelling and dilatation of the capillaries were observed in the submucosa. The p_H values of the combinations which produced no ill effects varied from 5 to 9.4, thus seeming to prove that the mucosa can stand a considerable change in hydrogen ion concentration.

Callomon [107] conducted a number of experiments in normal mice to determine the effect on nasal mucosa of certain solutions of sulfonamide compounds. Each solution was dropped into the nose twice a day for fourteen days. Some of the animals were killed after five days of treatment and the tissues examined. Others were examined after fourteen days of therapy, and the remainder, five days after conclusion of the fourteen day treatment. Adequate controls were used for comparison. The results were as follows: A 3 per cent solution of sulfathiazole in propylene glycol, with a p_H value near the normal, had the least irritating effect. The greatest injury and the slowest recovery followed use of a 2 per cent solution of "diasone" (the disodium formaldehyde sulfoxylate derivative of diaminodiphenylsulfone) in propylene glycol; its p_H was 4.8. Return to normal was observed on the fifth day after the last treatment. A commercial preparation combining desoxyephedrine hydrochloride and sodium sulfathiazole in aqueous solution, p_H 9.2, caused an inflammatory and partly caustic effect during treatment, followed by slow return to normal. An interesting observation was the fact that a 3 per cent solution of "diasone," p_H 8.8, was less irritating than a 2 per cent solution, p_H —5.

107. Callomon, P. T.: Tissue Changes Produced in the Nasal Mucous Membranes of Normal Mice by Prolonged Local Administration of Some Solutions Containing Sulfonamide Compounds, Arch. Otolaryng. **43**:31 (Jan.) 1946.

To determine the efficacy of various methods of introducing medicaments into the nose, Cawthorne [108] conducted a number of experiments in which a 10 per cent solution of cocaine hydrochloride was used (1) by the drop method, (2) by nasal atomizer, (3) by sniffing and (4) by maintaining a head-low position. Results were tabulated according to the degrees of anosmia induced by the drugs, these degrees indicating the extent of nasal mucosa reached in the various procedures. The net result of the experiments was that the head-low position proved to be the most effective means of reaching a maximum expanse of mucosa. Nasal drops employed in the usual head-erect position were the least effective.

Lierle and Paul [109a] made a number of observations on the effect of penicillin administered orally in a series of 174 persons with various acute infections of ear, nose and throat. A number of preparations in which penicillin was combined with various buffer agents were employed, and blood levels were determined in 170 of the patients. It was found that the best clinical results were obtained from the use of capsules [109b] containing penicillin (16,000 and 48,000 units) admixed with aluminum hydroxide and cottonseed oil, a preparation which remained potent at room temperature for at least six weeks. Also, it was found that the best times for administering the drug were one hour before each meal, 10 p. m. and 2 a. m., the penicillin being given in doses of 100,000 units each for a total of 500,000 units in twenty-four hours. Few complications were noted, most of them rather mild, such as diarrhea, headache and nausea.

Penicillin was not found of much value in cases of acute rhinitis. In 14 of 17 cases of acute maxillary sinusitis improvement occurred without additional therapy.

Shirkey and Jackson [110] made some experiments on animals and the human subject with two new "straight chain" synthetic compounds (oenethyl and EA-83). These vasoconstrictors were found to be active for periods up to five hours and to produce no untoward effects.

Greenwood, Pittenger, Constant and Ivy [111] conducted a number of experiments on the mucosa of rabbits, to determine how various

108. Cawthorne, T.: Intranasal Medication, Ann. Otol., Rhin. & Laryng. **55**: 519 (Sept.) 1946.

109. (*a*) Lierle, D. M., and Paul, W. D.: Oral Penicillin in Otolaryngology, Laryngoscope **56**:352 (July) 1946. (*b*) "Glycillin," supplied by the Meta-Cine Company.

110. Shirkey, H. C., and Jackson, D. E.: Experimental and Clinical Observations Regarding the Nasal Vasoconstrictor Action of Oenethyl and EA-83, Ann. Otol., Rhin. & Laryng. **55**:859 (Dec.) 1946.

111. Greenwood, G.; Pittenger, R. E.; Constant, G. A., and Ivy, A. C.: Effect of Zephiran Chloride, Tyrothricin, Penicillin and Streptomycin on Ciliary Action, Arch. Otolaryng. **43**:623 (June) 1946.

concentrations of certain medicaments would affect ciliary activity. Their conclusions were as follows: Zephiran chloride in concentrations of 1:1,000 and 1:2,000 in distilled water stopped all ciliary activity within five to ten minutes. The same thing happened when plain distilled water was used with the controls. However, when zephiran chloride was placed in isotonic solution of sodium chloride, the same concentrations had no effect on the ciliary beat up to one hour. Tyrothricin in concentrations of 1:1,000 and 1:2,000 in distilled water also caused an arrest of ciliary activity in five to ten minutes. Penicillin in concentrations of 200 and 500 units per cubic centimeter of isotonic solution of sodium chloride had no effect on the cilia. Streptomycin in concentrations of 100, 300, 500 and 1,000 units per cubic centimeter of isotonic solution of sodium chloride also failed to disturb ciliary activity.

Boyd, Copeland and Lapp [112] performed a number of experiments in about 2,000 animals, including white mice, guinea pigs, rabbits and cats, to determine the degree of cerebral excitement that might result from the use of "tuamine." They found that even in large doses the drug did not produce deleterious cerebral excitation, and consequently they conclude that when used in inhalers as recommended for nasal decongestion the drug is perfectly safe in the normal therapeutic dosage.

Bettington and Vincent,[113] in a series of 60 cases of sinusitis, in 5 of which the condition was in the acute stage, found antibiotics to be of value only in the acute and subacute stages. They used sulfamerazine in the following doses:

1st day: 2 doses, 6 and 3 Gm.
2d day: 2 doses, 3 and 2 Gm.
3d day: 2 doses, 2 Gm. each.
4th day: 2 doses, 2 Gm. each.
5th day: 2 doses, 1 Gm. each.

Renal reactions were noted in 2 cases. Antral irrigations were done at intervals, when indicated. If no improvement followed four irrigations, instillations of penicillin were started.

The drug therapy was found to be effective also for postoperative recurrences, provided drainage was adequate.

Pugmire and Eberle [114] claim that sulfadiazine and penicillin are synergistic and when used in combination are more effective than when

112. Boyd, E. M.; Copeland, J., and Lapp, F. H.: Absence or Near Absence of Excitant Effects from Administration of Tuamine, Arch. Otolaryng. **44**:166 (Aug.) 1946.

113. Bettington, N. H., and Vincent, G. K.: Report on a Series of Cases of Sinusitis Treated by Chemotherapy at an Australian General Hospital, M. J. Australia **1**:358 (March 16) 1946.

114. Pugmire, A. S., and Eberle, D.: Topical Use of a Combination of Penicillin and Sulfadiazine in a Water-Soluble Base for the Treatment of Sinusitis, Rocky Mountain M. J. **43**:26 (Jan.) 1946.

used separately. To prolong the action of the drugs, they used as base a moderately thin water-soluble ointment and injected the solution into the antrum after an irrigation, using a 15 gage needle. Treatments were given at forty-eight to seventy-two hour intervals. The clinical results as indicated by cessation of discharge were good. However, no controlled experiments were done, nor was any attempt made to isolate the offending bacteria or to measure the blood levels.

Ruedi [115] discusses the effects of penicillin in three groups of cases, namely, cases with simple acute or chronic monosinusitis, cases of chronic sinusitis associated with bronchiectasis and cases of chronic pansinusitis with polyposis. In group 1 the condition responds favorably to penicillin administered both intramuscularly and by local instillation. In group 2 the conditions are little affected by penicillin. In group 3, on the other hand, favorable results are obtained if penicillin therapy is combined with adequate surgical treatment. Many of the patients of this group who have been subjected to previous operations and protracted therapy with frequent recurrences will show complete clearing up of their sinusitis if the foci of infection are cleaned out and penicillin therapy is continued during the healing stage. The author believes that in these patients bacterial allergy has developed, which accounts for the recurrences, and his observations of the beneficial effects of penicillin point to a specific action on this factor.

Burhoj [116] reports good results from the administration of sulfonamide compounds in 43 cases of acute suppurative pansinusitis; in 33 of the cases this condition was bilateral. The patients were divided into two groups, the first receiving a "streptamid" (para-aminobenzenesulfonamide) and sulfamethylthiazole (2-sulfanilamido-4-methylthiazole). The second group received sulfathiazole and "lucosil" (2-[para-aminobenzenesulfamido] methylthiadiazole). The first group recovered, on the average, in 10.95 days and the second group, on the average, in 9.5 days. (It is difficult to evaluate these statistics because the patients at the same time were receiving other forms of therapy, such as irrigations of the maxillary antrum, light and heat, and vitamins. S.S.)

Rouget and Lemariey [117] review their experiences in treating various infections of ear, nose and throat with penicillin and report excellent results in acute sinusitis. Chronic sinusitis was much less amenable. In the cases in which it seemed to improve at first, it usually reverted to the prior status after the lapse of a month. However, they found

115. Ruedi, L.: Nasennebenhöhlenentzündungen und Penicillin Behandlung, Schweiz. med. Wchnschr. **76**:189 (March 9) 1946.

116. Burhoj, E.: Kemoterapeutisk behandling af pansinuitis acuta suppurativa, Nord. med. **27**:1485 (July 27) 1945.

117. Rouget, J., and Lemariey, A.: La pénicilline en oto-rhino-laryngologie, Ann. d'oto-laryng. **13**:93 (March-April) 1946.

the drug helpful in cleaning up persistent infections following frontal sinusotomies. Also, they believe that preoperative administration of penicillin will often prevent postoperative complications. Eight cases of orbital complications are included in the series. The patients all recovered, and the authors feel that the penicillin had much to do with the favorable results. In such cases they do not resort to surgery unless incision is necessary for the release of pus, provided vision is not impaired and there have been no signs of intracranial involvement. The affected sinuses are opened and drained after the acute symptoms have subsided. Should an external operation be indicated, they use penicillin locally, by irrigation of the operative field, in addition to continuing the intramuscular injections.

Among the other complications favorably influenced by penicillin were frontal osteitis (4 cases) and aseptic meningitis (1 case). One patient with thrombosis of a cavernous sinus and 2 with brain abscess succumbed despite intensive therapy; also 2 of 3 patients with suppurative meningitis failed to recover.

Barach and associates [118] employed penicillin aerosol in a series of 110 cases of acute and chronic sinusitis. The apparatus was constructed to permit the mist to be introduced under positive pressure, after which a negative pressure of 20 mm. of mercury was induced by the turn of a valve, which forced the mist-laden air into the sinuses. In all, 122 courses of therapy were administered, one to four treatments being given each day for periods of from three days to two weeks. In 65 cases in which progress was checked by roentgenogram, improvement was noted in 39, no improvement in 22 and progressive involvement in 4. In 41 cases gram-positive organisms were found in cultures prior to therapy. The organisms disappeared after treatment in 24 of these cases, but persisted in the remainder. It was evident that in cases of chronic sinusitis or those in which sinusitis was associated with allergy the results of the therapy were negligible.

Fishman [119] advises that sodium penicillin be applied locally by the patient for acute sinusitis and infections of the upper respiratory tract; 100,000 units is dissolved in 50 cc. of distilled water and the solution kept in the refrigerator. Two or three cubic centimeters is transferred

118. Barach, A. L., and others: Penicillin Aerosol and Negative Pressure in the Treatment of Sinusitis, Am. J. Med. **1**:268 (Sept.) 1946. Barach, A. L.; Garthwaite, B.; Soroka, M., and Anderson, F. F.: Apparatus for Introduction of Penicillin Aerosol into Nasal Accessory Sinuses with a Case Report of a Patient with Chronic Sinusitis, Ann. Int. Med. **24**:97 (Jan.) 1946. Barach, A. L.; Garthwaite, B., and Rule, C.: Use of Penicillin Aerosol in Bronchopulmonary and Sinus Infections, New York State J. Med. **46**:1703 (Aug. 1) 1946.

119. Fishman, A. E.: The Common Atomizer as an Efficient Agent for Penicillin Inhalation in Bacterial Complications of Nasal and Bronchial Allergy, M. Rec. **159**:546 (Sept.) 1946.

to an atomizer which the patient carries about and uses every three hours during the day. He believes this procedure not only reduces the local symptoms but also saves the patient numerous trips to the physician's office. Several typical cases are cited.

Prenn [120] had good results when penicillin solution was instilled into the maxillary and sphenoid sinuses in 2 cases of chronic suppurative sinusitis. Concentrations of 500 to 5,000 units per cubic centimeter were used daily for five days in one case and for an unnamed period in the other.

Crawford [121] feels that penicillin may have a definite place in the therapy of purulent sinusitis if given intramuscularly in adequate doses. He reports that 6 patients had resisted the usual local therapy and were considered candidates for surgical intervention. Three of these yielded excellent results to penicillin, the discharge ceasing completely after total doses of 400,000 to 900,000 units had been given. Two of the others failed to respond and would probably need surgical treatment. The most satisfactory and promptest results were observed in 2 cases in which gram-positive cocci and Hemophilus influenzae were recovered on culture.

Berdal [122] finds suspensions of sulfathiazole of little value in the treatment of chronic maxillary sinusitis. He used a 10 per cent solution by instillation in the wake of irrigation in 42 cases and compared the results with those obtained in a series of 48 similar cases in which conventional treatment was given at the same time. The cases in which sulfathiazole was used required just as many irrigations and operations as the others, and no effect could be noted on particular strains of bacteria. Furthermore, the author believes that the solution employed had an irritating effect on the sinal mucosae.

Cardwell [123] reports the results observed when penicillin was administered locally for sinusitis. Sixty-one patients were treated in an Army station hospital and the results evaluated from the point of view of the sensitivity of the organisms present. Cultures were made of specimens removed under aseptic conditions, the sinus was then irrigated with 500 cc. of sterile isotonic solution of sodium chloride until clear, after which 1 to 2 cc. of a solution containing 500 units of penicillin to the cubic centimeter was instilled. Treatments were

120. Prenn, J.: Penicillin Instillations in Chronic Otitis Media and Sinus Infections, M. Rec. **158**:741 (Dec.) 1945.

121. Crawford, H. E.: Penicillin Therapy in Purulent Maxillary Sinusitis, Hawaii M. J. **5**:135 (Jan.-Feb.) 1946.

122. Berdal, P.: Local Treatment with Sulfathiazole in Sinusitis, Acta otolaryng. **33**:345, 1945.

123. Cardwell, L. P.: Penicillin Administered Locally in Treatment of Disease of Nasal Accessory Sinus, Arch. Otolaryng. **44**:287 (Sept.) 1946.

repeated at intervals of two to four days. Home treatment consisted of the use of nose drops containing 0.065 mg. of iodine, 0.2 mg. of menthol and 0.32 mg. of camphor in 30 cc. of thin petrolatum. Between washings the patient was treated with a 5 per cent cocaine spray, suction and occasionally a 10 per cent mild silver protein pack. Bacterial growth was present in 37 of the 61 cases. In these cases the response to therapy was prompt. In no cases were untoward effects observed. Hyperesthetic rhinitis occurring with sinusitis gave a poor prognosis for relief; likewise, hyperplastic disease and polyps. The author believes that he obtained better results with penicillin than with the usual routine therapy.

Kraus [124] has had encouraging results from the use of penicillin, 1,000 units to the cubic centimeter of solution, in acute rhinitis and acute and chronic sinusitis. The solution was used in the form of nose drops every three hours and by displacement or instillation daily. Some 59 cases are listed; in 20 the condition was acute, in 6 subacute, in 28 chronic and in 4 not defined. As might be expected, the results in all the cases of acute infection were uniformly good. In some of the cases of chronic disease there was prompt response; in others additional therapy was required and in a few the infection was resistant.

De Blois,[125] after employing penicillin locally in a variety of otolaryngologic conditions, found by careful bacteriologic studies that the agent was not bactericidal. In only a small proportion of the cases did the treated areas become sterile and in very few of these cases did those areas remain sterile for any length of time. While the drug does manifest definite bacteriostatic properties when applied to sensitive organisms, it was shown that after awhile the organisms may become penicillin resistant. One of the factors in its failure to render the respiratory tract free of pathogenic organisms is its rapid elimination, due to ciliary activity. It was most successful only in cases in which the solution could be maintained in contact with the infected area for a greater length of time, as in an infected maxillary antrum or in other sinuses into which it was introduced by the Proetz displacement method.

James [126a] reports good results from the use of a paste containing either a sulfonamide drug or penicillin. This was introduced into the maxillary or the sphenoid sinus in cases of subacute and chronic sinusitis. He states that the sulfonamide drug will remain active in the sinus as

---

124. Kraus, P. H.: Penicillin Therapy in Otorhinolaryngologic Practice, Arch. Otolaryng. **44**:647 (Dec.) 1946.

125. De Blois, E.: Penicillin in the Field of Otolaryngology, Arch. Otolaryng. **44**:174 (Aug.) 1946.

126. (*a*) James, J. A.: Local Chemotherapy in Paranasal Sinusitis. J. Laryng. & Otol. **60**:323 (Aug.) 1945. (*b*) Lanette wax Sx is supplied by Rosheim & Moore, England. It is an approximately 10 per cent sulfated or phosphated mixture of cetyl and stearyl alcohols.

long as a week; the penicillin, as long as five days. The formula is as follows:

Pulv. Sulfanilamide	2	20%
Pulv. Sulfathiazole or Sulfadiazine	1	
Proflavine sulfate (neutralized with Sod. Bicarb. ¼ part)		0.2%
Lanette Cream 16% Lanette wax SX [126b] in water		79.8%

Melt the Lanette wax, add the water and when thoroughly mixed add the sulfonamide and proflavine powders. The paste is sterilized in the autoclave in 17 c.c. (glass) containers, with screw cap loosened, at a pressure of 10 lb. per square inch for 15 minutes. Each container holds sufficient paste to fill a large antrum.

If a penicillin paste is desired, the formula just given is prepared without the proflavine and with 18 per cent Lanette cream, and the penicillin, 15,000 units in 2 cc. of sterile water, added to 14 cc. of the paste just before injection. Treatments are given at five to seven day intervals until the washings are clear. The author claims cures in 70 to 86 per cent of a controlled series of cases, compared with 32 to 41 per cent in parallel groups in which the antibiotics were not used.

Berger [127] cites several cases from the literature in which penicillin proved its worth and adds a case of his own in which a patient with osteomyelitis involving the maxilla, the zygoma, the frontal and the parieta bones recovered in consequence of extensive surgical treatment reenforced by intensive penicillin therapy. The patient had active syphilis, which was not influenced by antisyphilitic and sulfonamide therapy until a surgical procedure and penicillin were employed.

Smith [128] found the use of penicillin to be of inestimable value in cases of acute sinusitis, particularly in cases of severe involvement with impending osteomyelitic or orbital complications. Under these circumstances it is advisable that the drug be employed parenterally as well as locally. In one instance, owing to the gravity of the symptoms, it was necessary to drain the frontal sinus by way of an opening that was made in the floor. In another case an orbital abscess was incised. In a third case, in which definite signs of osteomyelitis were present, the process was halted, and healing resulted without recourse to surgery. The author states that in chronic sinusitis it is difficult to assess the value of penicillin either internally or locally, and one might gather from his few remarks on this phase of the topic that judgment must be suspended until a larger group of cases can be studied over a considerable period.

---

127. Berger, I.: Penicillin in Otolaryngolic Practice, Arch. Otolaryng. **43**:19 (Jan.) 1946.

128. Smith, A. T.: Clinical Use of Penicillin in Infections of the Ear, Nose and Throat, Arch. Otolaryng. **43**:12 (Jan.) 1946.

Everett,[129] comparing sulfathiazole and penicillin as employed in a series of 95 cases of acute and chronic maxillary sinusitis, came to the conclusion that a solution of sulfathiazole sodium in combination with a vasoconstrictor was more effective than a solution of a penicillin salt when instilled into the sinus after irrigation. In no instance did he encounter any deleterious effects with either agent. He believes that the antibiotic definitely limits acute and subacute infections and that in a certain number of cases of chronic infection it produces spectacular results.

Morse[130] reports excellent results obtained in a series of 25 cases of infection of the respiratory tract with use of a penicillin spray, administered through a simple atomizer. The solution is prepared by adding 10 cc. of cold sterile water to 100,000 units of penicillin, giving a concentration of 10,000 units per cubic centimeter. Various amounts of this stock solution, from 40,000 to 80,000 units of penicillin, are withdrawn and placed in sterile vials, diluted up to 2 drachms (7.5 cc.) for use in the atomizer. The solution may then be sprayed into the nose or inhaled through the mouth for conditions of the lower respiratory tract and is employed frequently enough to exhaust the total contemplated dose (40,000 to 80,000 units) within twenty-four hours. The author claims that this procedure is much simpler and less expensive than an oxygen tank combination recently publicized and that the results are as good. It was particularly effective in the treatment of bronchitis, pneumonia and bronchiectasis. Only 2 cases of sinusitis are reported, which is certainly insufficient for any definite conclusions.

Kleinfeld[131] describes a method of introducing volatile inhalants into the sinuses for decongestion. He uses a specially constructed metal cylinder which is screwed onto the commercial inhaler after the cap of the latter has been removed. The threads of the metal cylinder come in three sizes to fit the different makes of inhalers. Also, the cylinder has a finger suction release opening and a valve which releases the suction automatically when it reaches 180 mm. of mercury. This apparatus is introduced into one nostril, while the opposite one is occluded by the regular Sorenson suction tip and bottle. With the pump running, both nose pieces are occluded, the patient says "K K K," and when the negative pressure reaches 180 mm. of mercury the valve opens and air traveling through the inhaler is drawn into the nasal cavities. The number of such procedures at one sitting should be limited, since excessive use may cause vertigo.

---

129. Everett, A. R.: Local Use of Penicillin and of Sulfathiazole for Acute and Chronic Sinusitis, Arch. Otolaryng. **44**:468 (Oct.) 1946.

130. Morse, F. W.: Penicillin Spray by Bulb Atomizer in Respiratory Infections, J.A.M.A. **132**:272 (Oct. 5) 1946.

131. Kleinfeld, L.: Sinus Therapy by the Use of Volatile Inhalants, Ann. Otol., Rhin & Laryng. **55**:912 (Dec.) 1946.

Tremble [132] has had good clinical results from the use of a penicillin solution introduced by displacement. His procedure is to take material from the middle meatus and the nasopharynx for culture to identify the organisms. The agent seemed to be effective against most gram-positive bacteria. If Hemophilus influenzae, Friedländer's bacillus or Bacillus coli was found, he employed streptomycin.

Pneumococci could be destroyed in two or three sittings by using penicillin, 5,000 units to 1 cc. of a sterile saline solution.

Sulman [133] reports the results he obtained with "par-pen" (a solution containing "paredrine hydrobromide," 1 per cent, and penicillin, 800 Oxford units per cubic centimeter) in treating 61 patients for infections of the upper respiratory tract, both acute and chronic. The medication was applied by nasal tampon and in the form of nose drops. In 14 cases the results were excellent; in 41 they were good and in 5 only fair. There were no evidences of toxicity.

Weille [134] observed an interesting case in which pansinusitis with evidence of porosity of the frontal bone cleared up under penicillin therapy administered intramuscularly for three weeks. While the patient was under this treatment, an acute infection developed in the opposite maxillary and ethmoid sinuses, which previously had been unaffected. The same organism was recovered from both sides, but the author attributes the phenomenon to the fact that the particular strain of hemolytic Staphylococcus aureus that was present in the second infection was penicillin resistant. In support of this claim the author refers to the method of measuring penicillin sensitivity employed at the Massachusetts General Hospital. "A high degree of sensitivity is evidenced by absence of growth when 1 unit of penicillin per cubic centimeter of culture is employed." In the case in question 25 units per cubic centimeter was required to prevent growth.

The author states that osteomyelitis of the frontal bone may be successfully combated in some instances if penicillin is given at the rate of 200,000 units daily for three weeks, although there is no assurance that surgical intervention will be avoided. In the case cited the definite porosis of the frontal bone disappeared completely with all evidence of the sinus infection, as evidenced by the roentgenograms and local findings.

---

132. Tremble, G. E.: Antibiotics Used Locally in Sinus Infections, Canad. M. A. J. **54**:533 (June) 1946.

133. Sulman, L. D.: The Use of a New Vasoconstrictor-Penicillin Combination in the Treatment of Upper Respiratory Infections, M. Times, New York **74**:211 (Aug.) 1946.

134. Weille, F. L.: Maxillary Sinusitis and Ethmoiditis of the Right Side Developing During Intramuscular Injection of Penicillin for Pansinusitis of the Left Side, Arch. Otolaryng. **43**:136 (Feb.) 1946.

Monto and Lyle [135] cite the case of a man of 23 who had acute pansinusitis with orbital cellulitis and symptoms of meningeal irritation. Surgical drainage was postponed, pending a trial of penicillin therapy, which proved successful. The patient received a total of 895,000 units in ten days and recovered after having been subjected merely to a stab puncture in the trochlear region. Some pus was evacuated which, on culture, revealed gram-positive cocci.

Hunnicutt [136] reviews the trends in sinus therapy and enumerates the items in procedure which one should follow in arriving at a proper diagnosis and outlining the therapy. He stresses the importance of consulting with the internist or the pediatrician for a thorough appraisal of the patient's general condition, so that dietary deficiencies, endocrine imbalance, allergic disposition, personal habits, etc., may be adequately controlled. The examination must include roentgenograms and bacteriologic and cytologic studies, following the local examination.

Therapy should be planned so as to take advantage of the natural recuperative powers of the tissues, and no medication or surgical procedure carried out without full realization of what the consequences may be.

Peacock [137] stresses the importance of avoiding surgical operation in the treatment of acute sinusitis except in the presence of impending complications. He does not recommend the use of inhalations unless the sinusitis is accompanied by laryngitis or bronchitis. He recommends a spray containing ephedrine hydrochloride, 0.25 to 0.50 per cent, combined with cocaine hydrochloride, 3 per cent, in isotonic solution of sodium chloride, the cocaine salt being omitted under certain conditions. In some cases, in which the ciliary activity is paralyzed by an infection of unusual severity (attributed by the author to "increased acidity"), he advises the use of alkaline douches. Lavage of the maxillary antrum is recommended only if severe pain indicates retention of secretions. If acute frontal sinusitis fails to respond to conservative measures, he is in favor of removing the anterior end of the middle turbinate rather than attempting to lavage through the edematous nasofrontal tract.

Chemotherapy, in the opinion of the author, is a valuable adjunct of the treatment, and he recommends daily doses of penicillin up to 500,000 units.

---

135. Monto, R. W., and Lyle, P. L.: Treatment of Complicated Acute Sinusitis with Penicillin, Arch. Otolaryng. **43**:298 (March) 1946.

136. Hunnicutt, L. G.: Modern Treatment of Chronic Sinusitis, J. A. M. A. **133**:84 (Jan. 11) 1946.

137. Peacock, R.: The Treatment of Acute Nasal Sinusitis, M. Press **108**: 358 (Nov. 13) 1946.

McMillan [138a] lists the etiologic factors of sinusitis under three headings: "Predisposing factors," "Local factors" and "Exciting factors." The author is against probing or irrigating the sinuses on the ground that the procedure "tends to aggravate the disease." He also cautions against the prolonged use of vasoconstrictors. He recommends "rhinazine" [138b] for shrinkage and oral or parenteral administration of iodides. Adequate diet, ascorbic acid and a streptococcus-staphylococcus vaccine are recommended for general therapy.

Robison [139] again explains his method of applying hydrostatic pressure to the edematous mucosa of the maxillary antrum by inflating a balloon inserted for the purpose of emptying the dilated intercellular spaces and assisting lymphatic drainage. The rationale of this procedure is based on the assumption that normally, when these spaces become filled with fluid filtered from capillaries in consequence of local bacterial or allergic irritation, the pressure within the tissues is raised to the point where these tissues contained as they are in a rigid bony cavity, will allow the lymph to be pumped out by pulsations derived from the dilated arteriovenous system by hydrostatic pressure. The fibroblasts repeatedly exposed to the high protein content of the extravasated fluid proliferate to the point where the newly formed fibrous elements interfere with the normal expansion of the intercellular spaces. Stagnation results, with further progress of the fibrosis. The inflated bag will, therefore, by mechanical pressure, overcome the blockade.

Van Alyea [140] stresses the importance of the maxillary ostium in drainage of the sinus and points out the anatomic and pathologic factors that may interfere with its normal function. He believes that in the vast majority of cases chronic antritis can be cleared up without radical surgical operation if attention is paid to freeing the ostium of any unnatural barriers and applying the elements of conservative therapy. In the few cases in which these procedures fail, intranasal antrostomy, if adequately performed, is of value, provided that any foci of infection present in the ethmoid cells are not overlooked. The author is not in favor of radical removal of the sinal mucosa.

---

138. (*a*) McMillan, J. M.: Chronic Sinusitis: A Safe Management and Treatment, J. Oklahoma M. A. **39**:9 (Jan.) 1946. (*b*) "Rhinazine" is supplied by Lederle Laboratories, Inc. It is a preparation containing: sulfadiazine sodium, 1 per cent; sulfathiazole sodium, 0.1 per cent; d,l-desoxyephedrine hydrochloride, 0.1 per cent; glycerin, 0.2 per cent; sodium bisulfate, 1.0 per cent.

139. Robison, J. M.: Physiology and Functional Pathology of the Lymphatic System Applied to Allergy of the Nose and Paranasal Sinuses, J. Allergy **17**:53 (March) 1946.

140. Van Alyea, O. E.: Maxillary Sinus Drainage, Ann. Otol., Rhin. & Laryng. **55**:754 (Dec.) 1946.

Balt [141] offers a brief résumé of the usual therapy of acute sinusitis, but presents nothing new. He does not favor chemotherapy unless there are symptoms suggesting intracranial involvement.

McCullough [142] reports that acute sinusitis, mostly frontal, occurred in 15 of 1,500 employees of a New York factory during the period of a year. Headache and local tenderness were the symptoms relied on for diagnosis. Roentgenograms were not taken. As for therapy, shrinking agents were used, after which cotton swabs saturated with 10 per cent ichthammol in glycerin were inserted into the middle meatus and left in place for fifteen to twenty minutes.

To insure adequate sealing off of the nasopharynx during the displacement procedure, Hoilien [143] has the patient compress the lip and force air up from the lungs, as in blowing a trumpet. This forces the palate firmly against the posterior wall of the pharynx and helps in the production of an adequate reduction of pressure in the nasal passages when suction is applied at the nares. He has had successful results when using penicillin (1,000 units per cubic centimeter of isotonic solution of sodium chloride) after preliminary shrinking with a 1 per cent ephedrine hydrochloride spray.

Cohn [144] summarizes observations made in a series of 150 cases of acute and 100 cases of chronic sinusitis. He considers that in the great majority of cases diagnosis is easy if one is careful to get a complete history and takes the time to make a thorough examination, using roentgen studies, transillumination and antrostomy when indicated. He points out the possible errors in the interpretation of roentgen films, due to such factors as allergy and vacuum sinus.

In cases of acute infection he has obtained good results from the use of penicillin administered orally and parenterally. The local employment of antibiotics has not been productive of impressive results. The author believes that sulfonamide drugs often depress the local tissue defenses, and he therefore recommends the administration of proteins.

GENERAL CLINICAL OBSERVATIONS

In a round table discussion of sinusitis [145] La Charite stressed the value of roentgen therapy for subacute and subchronic sinusitis, explaining the rationale of the procedure. Henderson spoke of the role of allergy and pointed out the diagnostic aids which should be employed.

---

141. Balt, F.: Behandlung av akutt sinusit, Nord. med. **15**:2442 (Sept. 5) 1942.

142. McCullough, E. C.: Clinical Study of Fifteen Cases of Sinusitis, New York State J. Med. **45**:2656 (Dec. 15) 1945.

143. Hoilien, M. J.: An Improvement in Technique of the Proetz Method of Treating Paranasal Sinusitis, J. Aviation Med. **16**:358 (Oct.) 1945.

144. Cohn, B. M.: Diagnostico y tratamiento de las sinusitis, Rev. de otorrinolaring. **6**:149 (Dec.) 1946.

145. A Round Table Discussion on Sinusitis, Canad. M.A.J. **54**:464 (May) 1946.

Replying to a question concerning the use of Dowling packs, one discusser stated that they do not appear to injure the cilia but may hinder the flow of mucus, owing to clumping of the cilia.

Spillman [146] gives a brief review of the early history of roentgenography of the sinuses, beginning with Scheier in 1896, who showed a bullet in the cranial cavity and incidentally the outlines of the frontal sinus. In this country, Philip, of San Francisco, in 1902, duplicated the procedures of Scheier and Winckler in Europe, and in 1904 added impetus was given to roentgenologic study by F. C. Ard, who had just returned from a visit to Killian's clinic, bringing some of the latter's roentgen pictures of the sinuses. Caldwell and Coakley are given credit for further progress in this field.

A common cold research unit [147] is being established by the British Medical Research Council and Ministry of Health. It will be housed at the Harvard Hospital, which was built and equipped near Salisbury, Wiltshire, in 1941 and later given to the Ministry of Health by Harvard University and the American Red Cross for research in communicable diseases. The problem of the common cold is particularly complex and difficult because, apart from the chimpanzees, which are unsatisfactory for experimental purposes, it has not yet been possible to study the disease in animals. In the study of several other diseases progress toward prevention was not made until it became possible to observe them in animals. Thus a vaccine against yellow fever became possible only when rhesus monkeys and later mice were found susceptible to the virus. Similarly, not till ferrets were found susceptible to the virus of influenza was any progress made in the study of that disease. Therefore, the first objective in investigating the common cold is to find a susceptible animal.

In the research the first step will be to test on human volunteers the cold-producing activities of the materials being studied. The volunteers will be drawn from university students, who will first be isolated until it is certain that they are free from infection. After a few days' quarantine, their noses will be sprayed with material to see whether it contains virus. While these observations are being made for a period of ten to fourteen days, the volunteers will be out of contact with the outside world and with one another, except that, to avoid boredom, they will live together in pairs and may move about the countryside around the hospital, provided they avoid all human contacts. The volunteers are being carefully selected so that only those susceptible of

146. Spillman, N.: Early History of Roentgenology of the Sinuses, Am. J. Roentgenol. **54**:643 (Dec.) 1945.

147. Research on the Common Cold, Foreign Letters, J. A. M. A. **131**:935 (June 8) 1946.

exact discipline will be included. It is thought that progress of the research will be slow and that any spectacular advance is not to be expected.

Bolton,[148] in an article written for lay consumption, describes the general causes of sinus trouble and dispels some of the current superstitions and misinformation. However, while he offers good advice in a word of caution against self irrigation of the nose, he fails to point out the danger of long-continued use of nose drops, which is known to be harmful. Also, his discussion of the use of antibiotics is more sanguine than authentic reports would justify.

Skadhange and Kjaer[149] found that if hemolytic streptococci were present in the noses and throats of patients about to undergo operations involving these areas, the hazard of postoperative complications was increased. In 96 such cases the percentage of postoperative complications was 52. On the other hand, in a series of 144 patients undergoing similar operations who were preoperatively free from hemolytic streptococci the percentage of complications was only 14. They therefore recommend that operations be postponed until the nose and the throat have been cleared of the bacteria.

INVOLVEMENTS OF THE FRONTAL-ETHMOID REGION

Van Alyea[150] describes the barriers which anatomic variations set up against drainage of infected frontal sinuses and emphasizes the necessity of providing adequate channels for relief in such cases. He has found that in most cases this can be accomplished by infraction of the middle turbinate and irrigation of the sinus. These measures should be employed as soon as the acute symptoms have subsided. Should other factors be present, such as a deviated septum, nasal polypi or a concurrent infection of other sinuses, these should be taken care of, if chronicity or recurrence is to be avoided. The external approach is reserved for cases in which the infection resists persistent conservative treatment and there is need to release pus that is under pressure or to remove cells and growths from within the sinus which block drainage, and for the treatment of malignant growths, osteomas and infections involving bone.

Bretton[151] states that the therapy of orbital complications of acute sinus disease depends on the answer to the question "Is there or is there not pus in the orbit? From this point of view he separates the

148. Bolton, W. W.: Sinus Common Sense, Hygeia **24**:504 (July) 1946.

149. Skadhange, K., and Kjaer, M.: Hemolytic Streptococci in the Nose and Pharynx, Acta oto-laryng. **33**:147, 1945.

150. Van Alyea, O. E.: Frontal Sinus Drainage, Ann. Otol., Rhin. & Laryng. **55**:267 (June) 1946.

151. Bretton, R.: A propos des manifestations orbitaires des sinusites aigues fronto-ethmoïdales, Ann. d'oto-laryng., April-June 1942, no. 4-6, p. 79

cases into two groups, namely, orbital cellulitis and orbital abscess. In the former, the onset is rapid, often stormy, the course is brief and the prognosis is good. Although there is edema of the upper lid, chemosis is usually absent, and although there is proptosis, the eyeball is not fixed, vision is unimpaired, the corneal reflex and pupillary reactions are undisturbed and the fundus is normal. These conditions run a brief course, and the symptoms subside with adequate intranasal drainage.

Phlegmon of the orbit, on the other hand, is accompanied by more severe symptoms: The temperature fluctuates at high levels, pain is intense, edema and chemosis are marked, the bulb soon becomes fixed, vision deteriorates and the corneal and pupillary reflexes are impaired. In these cases the indications for early drainage are urgent and embrace both intranasal and external exploration.

The author describes the physiopathologic, anatomic and clinical factors which bring about these complications.

Rebattu and Rabaste [152] cite 3 cases of agenesis of the frontal sinus in which the regular appearance of severe frontal headaches prompted them to apply a surgical procedure. This consisted in trephining into the dense bone at the superointernal angle of the orbit, creating an artificial cavity, which was then tunneled to lead into the nasofrontal duct. In 2 cases complete relief was obtained, and in the third case there was improvement. The authors claim that this procedure is indicated when severe pains occur in the region of the sinus radiating into the orbit and temporal regions in cases in which the usual signs of infection are absent and the roentgenograms show absence of the frontal sinus. The bone is usually found to be thick and cancellous.

There is nothing in the article to indicate whether the authors expected the artificial cavity or passage to remain permanently open. They believe that the pains arise from irritation of terminal fibers of the ophthalmic nerve and the sympathetic fibers of the ophthalmic ganglion, occasioned by the block of solid bone occupying the space where the frontal sinus is normally found.

In the case reported by Salomon and Engelsher,[153] a youth of 20 presented a walnut-sized smooth mass over the temporal half of the superciliary arch. There was no history of trauma, and the family history, as well as the blood picture, contained nothing relevant. The mass was removed and was found to have eroded the outer table of the bone. Histologically, it was a nonspecific granuloma. A number of eosinophils with bilobed and trilobed nuclei were present among connective tissue cells, which in some areas appeared edematous and

152. Rebattu J., and Rabaste: Les troubles dus à l'agénésie du sinus frontal: Leur traitement chirurgical, J. de méd. de Lyon **27**:655 (Sept. 20) 1946.

153. Salomon, N. I., and Engelsher, C. L.: Destructive Granuloma of Bone in the Skull, New York State J. Med. **46**:183 (Jan. 15) 1946.

resembled the foam cells of Christian-Schüller disease. There were also a number of multinucleated giant cells of the osteoclastic type.

Louw [154] cites the statistics of Morris and Henschen relating to the frequency of hyperostosis frontalis and draws on his own experience, comprising some 80 cases. These were encountered in a large series of cases in which roentgen studies were made over a considerable period in a general hospital. It appears that 4.4 and 6.5 per cent, respectively, of all cranial roentgenograms revealed evidences of this condition. In a three year period 51 cases of hyperostosis frontalis were discovered. The author promises a continuation of the investigation.

In the most comprehensive article on hyperostosis frontalis interna in recent years, Oldberg [155] analyzes the pathogenesis of various conditions associated with thickening of the cranial bones in an attempt to find some correlation between them and hypophysial dyscrasias and also senile diabetes. For anyone who is particularly interested in this subject the article furnishes a wealth of material, which is followed out to the last detail. Certain conclusions are reached, which merit repetition:

The Stewart-Morel syndrome is justifiably an entity because the symptoms of hyperostosis frontalis interna, adiposity, headaches and dizziness are usually associated and occur in females near the menopause, which is usually delayed. The condition therefore seems to have its origin in an endocrine imbalance. On the contrary, the author does not agree that there is justification for the so-called Morgagni syndrome, because the aforementioned symptoms do not bear any relationship to circulatory disturbances or blood pressure.

General thickening of the calvarium can usually be attributed to hypophysial disturbance. It is most pronounced in acromegaly; in the Stewart-Morel syndrome it affects the frontal and parietal bones. In both conditions the author has found an enlargement of the sagittal diameter of the atlas. This association, therefore, seems to indicate a general tendency of growth in the skeletal muscles, which again goes back to the hypophysial theory of origin.

These conditions may be seen in connection with a mild form of diabetes occurring in elderly persons who manifest decreased sensitivity to insulin but who are subject to acidosis with risk of coma. This may be considered an extrainsular diabetes, due probably to a pituitary disturbance.

The author concludes with the statement that:

---

154. Louw, A.: Om hyperostosis frontalis interna, Nord. med. **20**:2121 (Dec. 4) 1943.

155. Oldberg, S.: Ueber die Bedeutung der Hyperostosis frontalis interna und einiger verwandter Skelett-veränderungen unter besonderer Berücksichtigung der Verhältnisse bei Altersdiabetes, Upsala läkaref. förh., Dec. 1, 1945, p. 1.

... the occurrence of the hyperfunction of the anterior lobe of the pituitary gland, especially in women after menopause, formerly chiefly recognized by an increased excretion of gonadotropic hormone, includes even a growth-promotive factor and probably also a diabetic one. The practical value of the aforementioned changes of the skeleton as a clinically easily diagnosed sign of hyperpituitarism is emphasized.

In addition to Oldberg's article there have been a number of other contributions dealing with the same topic.[156]

For the most part they comprise case reports, the usual references to the literature and speculations concerning the pathogenesis. Painchaud [156e] shows a number of roentgenograms of skeletal members with structural changes due to altered metabolism. These are hooked up with determinations of urinary and blood calcium and arguments tending to prove the common endocrine basis.

Vila's [156b] article is a statistical analysis of a series of cases with figures showing the percentages of the various symptoms and findings. He also includes several drawings taken from the work of Pancoast, Pendergrass and Schaeffer (1942) entitled "The Head and Neck in Roentgen Diagnosis."

The other articles mentioned are devoted principally to case reports.

Di Lascio [157] also devotes considerable space to an analysis of the Stewart-Morel syndrome, covering the same ground as the other authors, and cites 2 cases. Clinically they were alike, but roentgenologically they differed. In one instance the thickening of the frontal bone was quite evident, whereas in the other nothing was apparent except a calcification of the falx cerebri. The author believes that they represent different stages of a process based on disturbance of the sympathetic and endocrine mechanism. Since the bony changes are but one of the many findings in these cases, it is important that repeated roentgenograms be taken in order to follow the progress of the disease.

Allisson, Berthoud and Brantmay [158] observed a patient with acromegaly combined with hyperostosis frontalis interna over a period of

156. (*a*) Ferroz, A., Jr., and Ribeiro, E.: Hiperostose frontal interna, Amatus **2**:183 (March) 1943 (*b*) Vila, O.: Contribución al estudio del sindrome Morgagni-Morel: La hiperostosis frontal interna en los diabéticos, Rev. méd. de Rosario **35**: 963 (Nov.) 1945. (*c*) Mascheroni, H. A.; Reussi, C., and Iturbe, R. R.: Sindrome de Morgagni: Hiperostosis frontal interna asociada a obesidad, cefallas y variaciones de trofismo articular vertebral y sacro, Rev. Asoc. med. argent. **59**:1316 (Nov. 30) 1945. (*d*) Mollaret, H.; Mollaret, M. P., and LeBeau, M. J.: Sur l'autonomie du syndrome dit de l'hyperostose frontale interne de Ferdinand Morel, Rev. neurol. **73**:452 (Sept.-Oct.) 1941. (*e*) Painchaud, C. A.: Presentation d'une malade atteinte d'hyperostose frontale, Laval méd. **2**:374 (April) 1946.

157. Di Lascio, A.: Sindrome de hiperostose frontal interna: Contribuicao ao estudo clinico, Neurobiologia **8**:101 (June) 1945.

158. Allisson, F. H.; Berthoud, F., and Brantmay, H.: Un cas d'acromégalie combinée avec une hyperostose frontale intern, observé pendant quatorze années, Confinia neurol. **6**:244, 1945.

fifteen years. The typical symptoms of Morel's syndrome, psychic and somatic, were absent however. Most characteristic were the evidences of endocrine disturbance: hyperthyroidism and enlargement of the pituitary gland. Roentgen therapy effected some reduction of the latter and also seemed to stimulate definite recalcification of the partially absorbed clinoid processes.

Bergquist,[159] in reporting a case of mycosis of the frontal sinus, states that he has been able to find only one similar case previously reported in the literature. A 45 year old seaman had exhibited symptoms of a unilateral chronic frontal sinusitis, which recently had become aggravated. Conservative therapy failed to ameliorate the symptoms, and the sinus was therefore opened externally. It was filled with a greenish yellow putty-like mass that was nonodorous. The mucosa, though thickened, was generally in good condition. The laboratory report on the specimen was as follows: "The sample sent in consists of a dense mycelium of partly necrotic and calcified masses of fungus, certainly a species of Hyphomycetes. Certain caked, hyalinized parts seem also to resemble trichomycetes."

Johnson and Zonderman[160] review the literature on eosinophilic granuloma and report a case in which the frontal bone was involved. The patient was a woman of 21 who complained of frontal headaches that followed a cold which occurred two and one-half months previously. More recently, the eyelid and brow became puffy, and there was some displacement of the bulb. This was followed by diplopia and local discoloration. The symptoms and roentgen findings suggested a mucocele. At operation a mass was found in the outer angle of the orbit, which was separated from the frontal sinus by healthy bone. However, it was attached to the dura, from which it could be separated with trauma. The ethmoid cells, being diseased, were cleaned out. The histologic diagnosis was "eosinophilic granuloma of the frontal bone." The extirpated mass measured 15 by 10 by 5 mm. Roentgen therapy was administered, and the patient is still under observation. The section which is shown in the article displays a cellular tumor with little stroma, infiltrated with histiocytes and polymorphonuclear leukocytes (eosinophils) with an occasional giant cell.

Lund[161] has found that in acute infection of the ethmoid labyrinth local pain and tenderness can be elicited at the point where the nasal branch of the anterior ethmoid nerve emerges along the edge of the piriform aperture. Also, pain can be elicited by pressing on the upper

159. Bergquist, B.: A Case of Mycosis of the Frontal Sinus, Acta oto-laryng. **33**:341, 1945.

160. Johnson, C. J., and Zonderman, B.: Eosinophilic Granuloma, Ann. Otol., Rhin. & Laryng. **55**:938 (Dec.) 1946.

161. Lund, R.: Symptoma ethmoidale anterius, Hospitalstid. **17**:85 (Jan.) 1943.

lateral cartilage against the edge of the bone. He found this symptom present in 13 of 15 cases of acute infection.

MAXILLARY-DENTAL DISEASE

Hubbell [162] reports an unusual case. A woman of 50 had an acute infection of a maxillary sinus, which was irrigated just once, relieving a toothache that originally brought her to the oral surgeon. The next day she complained of difficulty in swallowing and trismus. Routine examination showed nothing relevant, and though the possibility of tetanus was considered, it was dismissed because there was no lesion on the body. Within twelve hours of admission to the hospital the trismus became complete and muscular contractions of the neck appeared. Antitetanus serum was given but failed to halt the progress of the disease. Convulsions became general and recurred frequently, and the patient succumbed within twenty hours.

Considering the possible atrium of infection, the author mentions the possibility that a tetanus-producing spore entered via an ulcer or a fissure somewhere in the gastrointestinal tract or by way of a small healed lesion of the hands or the feet, the spore being temporarily dormant.

Carlens [163] reports 2 cases of sinusitis caseosa affecting the maxillary sinus. Both patients were women of 37. In the first case there was no definite history of sinusitis, the patient complaining of moderate obstruction and some malodorous discharge. The nasoantral wall on one side seemed pushed medially, and the sinus was dark on transillumination. A Caldwell-Luc operation was done, revealing that the sinus was filled with a foul cheesy mass, which had eroded part of the nasoantral wall and reduced the anterior wall of the sinus to paper thinness.

In the second case there was a history of a sinus discharging for several years. Operation disclosed a condition more advanced than that in the previous case, there being dehiscences in the canine fossa and above the alveolus over the posterior molar teeth, as well as complete resorption of the bony nasoantral wall. Also, portions of the mucosa revealed cancerous degeneration.

The author ascribes the condition to retention of thick secretion in chronic sinusitis. He does not believe it is necessary that the ostium be completely blocked, as postulated by Nussman, since in both cases it was possible to force irrigation fluid through a puncture, albeit in the face of considerable resistance.

---

162. Hubbell, A. O.: Fatal Tetanus Associated with Acute Maxillary Sinusitis, J. Oral Surg. **4**:328 (Oct.) 1946.

163. Carlens, E.: Sinusitis Caseosa, Acta oto-laryng. **34**:489, 1946.

Noonan's [164] patient was a 24 year old soldier who complained of a foul taste in his mouth. This preceded a blow he received over the cheek, which resulted in swelling and his being referred to the dental clinic, where a fistula was found in the region of the third upper molar tooth. Incision, however, failed to reveal a tooth. Later the roentgenograms showed a tooth in the antrum, which was located in the posterior and mediosuperior wall of the sinus. A Caldwell-Luc operation was performed. The sinus was full of thick purulent discharge, the membrane was hypertrophied, and the tooth was embedded in the posterior and superior walls, from which it was extracted. It proved to be a molar tooth with one rudimentary root. The alveolar fistula was curetted and healed promptly.

Glennie's [165] patient was a man of 60 who suffered severe headaches of a migrainous nature over a period of years. He gave a history of having had a number of carious teeth removed some years before, which however, failed to relieve the headaches. Roentgen studies, made with iodized poppyseed oil 40 per cent, showed pathologic conditions in both antrums. These were opened via a sublabial incision, and one of them revealed a curtain of mucous membrane stretching from the roof to the floor, dividing the sinus into two compartments. The author believes its origin may have been a dental cyst. The other antrum contained some polypi and thickened mucosa. The headaches were completely relieved.

In cases of chronic maxillary sinusitis of dental origin Jahn [167] advises that the offending tooth be removed and a series of irrigations begun via the inferior meatus, with instillation of 2 to 5 cc. of 10 per cent iodoform in glycerin. If the floor of the sinus is perforated during the extraction of a tooth, he cautions against any manipulations or probing of the fistula. Also, irrigations should be withheld, the cavity protected against food by temporary tampons, and the patient given injections of an antipyogenic vaccine. If, because of unusual fragility of the bone, a fragment is dislodged into the antrum, or a portion of a root is lost, it should immediately be recovered through an adequate exposure. Attempts to extract the fragment through irrigation or gauze packs should not be tolerated, since they only hasten an infection which may spread to the other sinuses. If the antrum is

164. Noonan, P. E.: Anomalous Antral Tooth, Arch. Otolaryng. **43**:134 (Feb.) 1946.

165. Glennie, N. S.: Severe and Long-Standing Headache Due to Dental and Antral Infection, Brit. M. J. **1**:526 (April 6) 1946.

166. Footnote deleted by the Reviewer.

167. Jahn, F. C.: Sinusitis maxilares de origen dentario, Arch. venezol. Soc. de oto-rino-laring., oftal., neurol. **6**:79, 1945.

already infected and the infection does not yield to a few irrigations, it should be opened and cleaned out.

Kennon and Osborn [168] state that in 30 of 350 cases in which aerodontalgia was studied and treated, this sympton was considered as due to aerosinusitis. In most of these cases it was found that the maxillary sinus extended into the alveolus in close proximity to the roots of the second bicuspid or first molar tooth, which accounted for the pains being referred to the teeth. Clinically, the referred pair may be differentiated from aerodontalgia of dental origin by the fact that it persists for some time after the patient has reached ground level; in the true dental cases such persistence does not occur. If pain of the teeth should come on after descent, the differentiation can be made by roentgenogram or by the pulp tester.

Neto [169] cites 2 cases in which maxillary sinusitis of dental origin was caused when local therapy was applied through the alveolar breech. In one of the cases apicitis of the first molar tooth had eroded through the floor of the antrum. In this case there is mention of a fetid nasal discharge, yet the symptoms and the roentgenologic findings indicated maxillary sinusitis. It was treated with a solution of silver nitrate according to a method which the author ascribes to Prof. Mario Bodan, and was cured after eight treatments. The other case was one of a frankly purulent maxillary-ethmoid sinusitis with fetor, due to a marked pericementoma of the palatine root of the first molar tooth. The tooth was removed by alveolotomy, and the sinuses were irrigated with dilute solution of sodium hypochlorite N.F. diluted 1 to 5 with water. Following each irrigation, the fistula was hermetically sealed. A cure was obtained after thirty-five irrigations. Roentgenograms taken thirty days later in both cases confirmed the results.

FOREIGN BODIES; FRACTURES

Coakley [170] treated a boy of 13 who complained of swelling of the right cheek. About three months previously a 22 caliber rifle was discharged about 3 feet (about 1 meter) from his face. Supposedly, the gun contained blanks, but in reality it was loaded with a soft-nosed, hollow point bullet. The bullet entered the left vestibule and came out below the right zygoma. Roentgenograms showed fragments of the bullet in the right antrum, in the sphenoid bone and at the point of exit.

168. Kennon, R. H., and Osborn, C. M.: Relation of Aerodontalgia to Aerosinusitis, Air Surgeon's Bull. **2**:434 (Dec.) 1945.

169. Neto, P.: Sinusites paranasais dentárias, Publ. méd., São Paulo (núm. 10) **16**:11 (May) 1945.

170. Coakley, L. P.: Gunshot Wound of the Right Maxillary Sinus, Eye, Ear, Nose & Throat Monthly **25**:454 (Sept.) 1946.

Richardson [171] reports a case in which an ordinary pin was lodged in the antrum for fifty-nine years. The patient had had an upper premolar tooth extracted at the age of 10. She tried to dislodge a blood clot from the socket with a pin, which was lost and remained unnoticed, although the patient had a nasal discharge which later became blood tinged. Roentgenograms revealed the foreign body, which was removed through an intranasal antrostomy via the crista pyriformis. The pin was found rusted and broken into several pieces.

Sillingardi [172] reports 3 cases of rhinolith of an inferior meatus of an adult. There was nothing out of the ordinary in the symptoms or the findings.

Cunningham and his associates [173] report 4 cases of rhinolith. One of the patients was a woman of 46 who had had a nasal discharge for thirty years following the removal of a tooth. Roentgenograms revealed a foreign body in the antrum. Above the alveolus was a fistula which barely admitted a probe. The foreign body was removed through a Caldwell-Luc incision and consisted of a nucleus and a calcareous covering. The nucleus was dense and resembled superficially the root of a tooth. However, no pulp cavity was demonstrable.

Lumsden [174] records observations made in a series of 20 cases of wounds of the face involving the sinuses, most of the lesions being caused by shell fragments or bullets. It is important to note that the interval between the injury and the first operation varied from a few hours to several weeks. The 9 patients whose frontal and ethmoid-sinuses were involved were seen on an average of twenty-four hours after injury, whereas the period preceding treatment of those with maxillary and maxillary-ethmoid involvement averaged two to six weeks. This was doubtless due to the fact that the latter group were first taken care of by the maxillofacial team before being turned over to the rhinologist. Dural involvement was noted in 3 cases, meningitis in 1 case and brain abscess in 1. The last was the only case to end fatally. The diagnosis of sinus involvement was made on the basis of the examination and the roentgenologic studies, frequently after iodized poppyseed oil 40 per cent had been instilled into the sinuses.

---

171. Richardson, G. A.: Foreign Body Involving the Maxillary Antrum, Arch. Otolaryng. **43**:508 (May) 1946.

172. Sillingardi, G.: Contributo allo studio dei rinoliti, Bol. d. Soc. méd.-chir. Modena **42**:649, 1941-1942.

173. Cunningham, A. T.; Lord, O. C.; Manley, C. H., and Polson, C. J.: Rhinoliths: The Report of an Antral and Three Nasal Stones, J. Laryng. & Otol. **60**:253 (June) 1945.

174. Lumsden, H. B.: War Wounds and Injuries Involving the Paranasal Air Sinuses, Edinburgh M. J. **52**:402 (Nov.) 1945.

In these delayed cases the therapy was as follows: An adequate external exposure was obtained either through the conventional curved supraorbital incision or the Caldwell-Luc approach as the indications required, and all diseased tissues were thoroughly removed. The frontal-ethmoid region was drained into the nose by removing the frontal process of the superior maxilla and the anterior end of the middle turbinate and inserting a large rubber tube to maintain the enlarged passage. In some cases it was necessary to obliterate the frontal sinus. The external wound or incision was closed with primary drainage for forty-eight hours. Sulfadiazine was given for about one week. (The results in this series were gratifying in view of the extent of the trauma and the infection of the sinuses. S. S.)

Canfield [175] discussed war injuries of the nose and sinuses before the Royal Society of Medicine and showed a number of colored lantern slides taken within ten days of the injury. The therapeutic principles followed in these cases included chemotherapy, removal of foreign bodies and thorough débridement, which includes complete cleansing of the sinuses and provision for drainage, also primary suture wherever possible after débridement.

Shea,[176] discussing the "compound facial injury," offers a few helpful suggestions in regard to diagnosis and treatment. He recommends early reduction except when the skull is fractured; then the operation must be delayed while the patient is kept at rest and given chemotherapy.

Fractures involving the maxillary sinuses are reduced by direct manipulation through the regular Caldwell-Luc incision. A rigid instrument is used as a lever to pry the displaced fragment into position. The author advises using the Ferris-Smith inflated balloon within the sinus to hold the fragments in position. It is left in situ for five to seven days. Roentgenograms are presented, showing the balloon in place.

Sillingardi [177] reports an unusual case of fracture of the base of the skull extending through the posterior wall of the frontal sinus in a man, the result of a fall in which the trauma was applied to the supraorbital region. The external lesion was not severe, and there was a comparatively symptomless interval of several days before the patient manifested evidence of severe intracranial involvement. Meningitis developed, rapidly leading to death. Autopsy revealed a diffuse purulent basilar meningitis, spreading from a perforation of the lamina basilaris and extending into the posterior wall of the frontal sinus. There was marked edema of the brain with numerous circumscribed hemorrhages.

175. Canfield, N.: Primary War Injuries Involving the Nose and Sinuses, J. Laryng. & Otol. **60**:458 (Nov.) 1945.

176. Shea, J. J.: Management of Fractures into the Nasal Sinuses, Laryngoscope **56**:22 (Jan.) 1946.

177. Sillingardi, G.: Lesione accidentale al capa da punta impropria, Bol. de Soc. méd.-chir. Modena **42**:509, 1941-1942.

Laigle [178] reports an interesting case. A young woman was kicked by a mule, sustaining a compound fracture of the brow involving the frontal sinus. The bone was badly shattered, and brain tissue was seen bulging into the wound. A flap was turned up, and numerous splinters of bone and blood clots were removed. The roof of the orbit and the floor of the sinus were shattered, and orbital fat protruded into the cranial cavity. The lacerated dura was trimmed and closed with the help of amniotic membrane. The mucous membrane of the sinus was destroyed with the electrocautery. The wound healed admirably except for a small persistent fistula, due to a sequestrum; this was removed at a later date. As a result of the meticulous care taken in cleansing and repairing the wound, the patient did not suffer any permanent disability.

Escat [179] points out that wounds of the face involving the sinuses admit the conciliation of two diametrically opposing surgical principles, namely, primary suture and adequate drainage. Since it is important from the cosmetic point of view to avoid delayed suture of the wounds of the face, on the one hand, and to prevent infection, which is a frequent complication, on the other hand, the author lays down certain rules whereby primary suture and drainage can be simultaneously employed. The rules are as follows: 1. The patient must be taken care of within eight hours of the injury. 2. The traumatic field must be thoroughly cleansed and dead tissues completely excised. 3. The patient must be watched closely for at least a week. Secondary suture should not be done until the secretions are bacteriologically free from streptococci on repeated culture. Aside from these restrictions, every wound of the face involving the sinuses may be closed if at the same time the affected cavity is opened to permit secretions to drain freely into the nose. The author goes into the details of the surgical procedures necessary to accomplish these objectives and cites several cases.

Sartorius' [180] study of 30 cases of skull fracture involving the frontal sinuses is an important one, because in most of the instances the injury was due to local trauma rather than to a fall, a collision or general traumatization of the skull. The author explains this rather unusual circumstance by saying that the wounds were the results of clashes occurring among native laborers in the mines, who amuse themselves by

178. Laigle, L.: Plaie cranio-cérébrale interessant les sinus frontaux, Lyon chir. **41**:380 (May-June) 1946.

179. Escat, M.: äLes plaies sinuso-faciales en chirurgie de guerre, Oto-rhino-laryng. **28**:241 (Sept.) 1940.

180. Sartorius, K.: Fractures of the Skull Involving the Frontal Air Sinuses Due to Localized Violence: A Study of Thirty Cases, South African M. J. **20**: 202 (April 27) 1946.

fighting with clubs and other missiles. In a number of the cases the patient explained his injury as due to his being struck by a rock in blasting.

In most of the cases the fracture was compound. In 10 of the 30 cases the dura was lacerated, and in most of the cases the brain suffered more or less contusion. There were several cases in which the frontal lobe was severely lacerated, with bone fragments or pieces of the missile embedded in the substance. The author describes some of the cases in brief, and in a subsequent article which has not yet been received, he intends to discuss more fully the detailed management of these injuries.

MISCELLANEOUS CONTRIBUTIONS

Cawston [181] observed chronic sinusitis associated with high blood pressure in a man of 58. The pressure varied from 160 systolic and 100 diastolic to 235 systolic and 135 diastolic, always seeming to reach lower levels after lavage of the sinuses. It is difficult to evaluate properly the efficacy of the treatments of the sinuses, because the patient also received medication for the hypertension and at times was moved to points of varying altitudes.

Corcos and Materi [182] report a case in which thrombosis of both cavernous sinuses and septicemia yielded to penicillin therapy. The thrombosis developed in a woman of 55 during the course of a pyogenic infection of the scalp which was being treated with compresses of dilute solution of sodium hypochlorite U.S.P. A striking feature of the case was two prominent red streaks appearing on the forehead and merging at the root of the nose, which stood out like cords and were hard and tender. Another was black vomitus, which was present for the first two days. Penicillin was given intravenously in doses of 25,000 units every four hours for several days. Recovery ensued in a few days, but the pustular condition of the scalp persisted for two weeks despite sulfonamide therapy.

In an article designed for the lay reader, Eggston [183] gives a direct and simple explanation of allergy and of the manner in which it is related to sinusitis. The illustration showing the direction of normal air currents of the nasal passages should be particularly enlightening to the nonmedical reader.

Another case of thrombosis of a cavernous sinus is reported by Gouvea,[184] in which recovery resulted from the administration of sulfon-

181. Cawston, F. G.: The Association of Nasal Sinusitis and a Raised Blood Pressure, Clin. J. **75**:104 (May-June) 1946.

182. Corcos, A., and Materi: Thrombo-phlébite double des sinus caverneux: État septicémique; Vomito-negro; Guérison par la pénicilline, Bull. et mém. Soc. méd. d. hôp. de Paris **62**:88, 1946.

183. Eggston, A. A.: Allergy and Chronic Sinusitis, Hygeia **24**:77 (Jan.) 1946.

184. Gouvea, A.: Abcesso do septo nasal; tromboflebite do seio cavernoso; cura, Publ. méd., São Paulo (núm. 10) **16**:23 (May) 1945.

amide drugs and drainage of the local focus. The patient was a man of 24, who started with a septal abscess of unknown origin and rapidly presented the classic symptoms of sepsis, the usual ocular disturbances and signs of impending meningitis.

Skillern [185] states that in many cases of sinusitis and nasal congestion the patient complains of pain and local tenderness occurring in the nape of the neck over the region of the great occipital nerve. A 2 per cent solution of procaine hydrochloride injected into these tender areas relieves the pain, and decongestion of the nasal tissues and improved drainage of the sinuses follow. The author describes the technic and mentions the locale as being "on each side of the midline over the trapezius [muscle] about 4 fingerbreadths below the external occipital protuberance close to a transverse crease, although an occasional accessory spot higher up toward the superior nuchal crest must not be overlooked."

Jahn [186] lists a number of causes of headache and makes a differential diagnosis between sinus pains and trigeminal neuralgia in more or less textbook fashion. Nothing new is added.

Chavanne [187] calls attention to the large number of patients complaining of nasal hydrorrhea, which has been found to be due to a low metabolic rate. This hypothyroidism was due, no doubt, to the lack of proper food during the war years. The author believes the condition merits distinction as a definite clinical entity under the name "hydrorrhoea nasales simplex."

Vall [188] goes into considerable detail in describing the characteristics of allergic phenomena observed in the upper respiratory passages and the usual differential diagnostic features. He mentions the common allergens found in his vicinity, describes the skin tests and emphasizes the importance of examination of smears and of the blood and investigation of the sinuses. All the well known conservative therapeutic measures aimed at drainage and ventilation are considered, as well as the outlines of the antiallergic treatment.

Cody [189] discusses briefly the various conditions of the ears, the nose and the throat which may cause headache and points out the essential differential items.

---

185. Skillern, P. G.: A New Method for Nasal Decongestion and Sinus Drainage, M. Times, New York **74**:42 (Feb.) 1946.

186. Jahn, F. C.: Cefaleas, neuralgias y dolores sinusales: Diagnostico diferencial, Arch. venezol. Soc. de oto-rino-laring., oftal., neurol. **6**:73, 1945.

187. Chavanne, L.: Hydrorrhée nasale simple thyroïdienne, Ann. d'oto-laryng., July-September 1945, no. 11, p. 414.

188. Vall, R. A.: Caracteristicas generales de los procesos alergicos en las vias respiratorias altas, M. Clin. **3**:146 (Aug.) 1945.

189. Cody, C. C., III: Headaches from the Otologist's Point of View, J. Michigan M. Soc. **45**:482 (April) 1946.

Wright and Boyd[190a] suggest the term "aerohematoma" to describe a clinical entity which they encountered in 12 aviators. In 11 cases it occurred when the subject was making a simulated flight in a low pressure chamber, and in only 1 case was it recorded as a result of actual flying. The author refers to Hermann's report of 4 cases, published in 1923, and abstracted in one of these reviews.[190b]

The diagnosis was made by finding a smooth round shadow on one of the walls of the sinus in a roentgenogram or by recovering blood on irrigation. In one case the diagnosis was corroborated by examination of tissue removed at operation. A review of the case histories shows that in all but a single case the symptoms and the pathologic process developed as a result of descending rapidly from a higher to a lower altitude, and the symptoms were always referable to the region directly over the affected sinus. In the 11 cases in which the sinus was not operated on, resorption of the hematoma occurred in periods ranging from three to ten weeks.

---

190. (*a*) Wright, N. W., and Boyd, H. M. E.: Aerohematoma of the Sinuses, Arch. Otolaryng. **43**:357 (April) 1946. (*b*) Hermann, A.: Laceration of the Mucous Membrane and Hematoma of the Nasal Sinuses in Aviators, abstracted, Arch. Otolaryng. **37**:739 (May) 1943.

Abstracts from Current Literature

Ear

ETIOLOGY OF OTOMYCOSIS: AN EXPERIMENTAL STUDY. W. B. SHARP, M. B. JOHN and J. M. ROBISON, Texas State J. Med. **42**:380 (Oct.) 1946.

The authors report that 40 cases of otomycosis were studied for evidence of the etiologic factors of the infection. Clinical data were recorded in each case, and a specimen of exudate was sent to the mycologic laboratory; cultures were made, and when sufficient material was present, a direct microscopic examination was included.

The condition is of limited geographic occurrence. It is most frequent in tropical and subtropical climates. In the United States the reported incidence is greatest in Florida. The condition is frequently encountered in the Galveston area of the Texas coast. Cases occur throughout the year, but the incidence is greater during the summer. Age, sex and race exert no significant influence on the incidence of otomycosis except that it is rare in children. In most of the cases in which cultures yielded growths of organisms, these were identified as either Aspergillus niger or Aspergillus flavus, the former occurring with about twice the frequency of the latter. Scopulariopsis, Penicillium, Actinomyces and Aspergillus glaucus were encountered, but infrequently. Water in the ears favors the growth and multiplication of the fungi. Another contributing factor is a lack of cerumen in the affected ear. Sutton is quoted to the effect that the disease is "secondary to pathologic conditions involving maceration of skin, eczema, furunculosis, or chronic discharge."

In conclusion the authors state:

"1. The fungi associated with otomycosis are ordinary saprophytes, such as occur on the normal skin, usually though not always Aspergillus niger, or A. flavus. In localities where they abound, and under circumstances favorable to the germination of spores that gain entrance, these fungi may proliferate in the auditory canal.

"2. Excessive proliferation there leads to the highly characteristic signs of otomycosis. A plug of thick pulplike exudate forms, which consists largely of exfoliated epithelium and fungus mycelium. This characteristic development may be regarded as a complication of prior pathologic conditions not shown to be mycotic.

"3. The external auditory canal does not favor excessive fungus multiplication when normal, but only when its physiology is altered. Such alteration occurs because of discharge from the middle ear in acute or chronic otitis media, removal or lack of formation of cerumen, or changes in the anatomical structure such as follow injury or reconstruction in radical mastoid operations."

SINGLETON, Dallas, Texas.

EXTERNAL OTITIS. JAMES T. ROBISON, Texas State J. Med. **42**:384 (Oct.) 1946.

Robison calls attention to the frequency of otitis externa in the southern states. Climatic conditions present in this section of the country and the absence of the cerumen of the external auditory canal are given as the most important factors contributing to the production of "external otitis."

Three types of otitis externa (the fungous ear, the acute desquamative external otitis and the chronic desquamative external otitis) are described. A brief discussion of the treatment of each type of the disease is included.

Furunculosis of the external canal, erysipelas and diffuse chondritis are discussed as complications of the disease. The differential diagnosis between furunculosis and acute mastoiditis is discussed briefly. In elderly people carcinoma of the external auditory canal may occur in association with otitis externa; the author has seen carcinoma develop in a patient who was under treatment for otitis externa.

SINGLETON, Dallas, Texas.

TREATMENT OF ACUTE DISEASES OF THE MIDDLE EAR WITH SULFONAMIDE COMPOUNDS. A. RODEL, Pract. oto-rhino-laryng. **8**:499, 1946.

The author presents a series of 5 cases of acute infection of the middle ear in which some of the findings were atypical. The patients had all received various-sized doses of sulfonamide drugs, usually from the onset of the symptoms referable to the middle ear.

CASE 1.—The patient complained of otitic pain and received sulfonamide therapy. The pain continued for three weeks without improvement. Otoscopic findings were indefinite. Paracentesis did not produce pus. However, mastoidectomy revealed thrombosis and dehiscence of the wall of the lateral sinus. The patient presented the following atypical findings—normal temperature, absence of chills, four weeks' continuous use of sulfonamide compounds and yet at the time of operation well masked sinus thrombosis.

CASE 2.—The patient had an acute infection of the upper respiratory tract with pain in the ear and spontaneous perforation. He was immediately given sulfonamide therapy. Two days later severe headaches developed, with elevation of temperature and nuchal rigidity. A lumbar puncture revealed a slight increase of cerebrospinal fluid pressure; otherwise the findings were normal. Mastoidectomy revealed thrombosis of the lateral sinus and of the jugular bulb, with thrombophlebitis involving the internal jugular vein and the facial vein. Three days later thrombosis of a cavernous sinus developed. This patient presented masked sinus thrombosis, which occurred in the first few days of the infection of the middle ear, and even though sulfonamide therapy was instituted on the first day of the illness, the pathologic involvement progressed to fatal thrombosis of a cavernous sinus.

CASE 3.—In this patient severe bilateral pneumonia developed. Sulfonamide therapy was instituted, and the pneumonia gradually subsided. However, a week later there occurred a rise in temperature and a spontaneous perforation of the left ear drum. The symptoms continued, and on admission to the hospital the patient had definite evidence of acute mastoiditis. Mastoidectomy revealed thrombosis of the lateral sinus and of the jugular bulb, and an epidural abscess of the cerebellum, which was due to Pneumococcus type III.

CASE 4.—The patient complained of pain in the left ear and of fever. Sulfonamide therapy was begun, and two days later there was a spontaneous perforation of the ear drum. Seven weeks later the patient was discharged as cured. However, within three weeks the symptoms recurred, with extreme pain in the ear but without fever. Mastoidectomy revealed thrombosis of the lateral sinus and abscess of the wall of the sinus. This was definitely a case of prolonged mastoiditis masked by the use of sulfonamide drugs, and even though there was absence of septic temperature and of chills, extensive thrombosis of the lateral sinus was found.

CASE 5.—The patient contracted bronchitis with bilateral otitis media and had an elevated temperature. Three days later there was a bilateral discharge, with slight tenderness over the tip of the mastoid process. Sulfonamide therapy was instituted. The fever subsided, and although the patient looked toxic, there was no evidence of intracranial complications. However, mastoidectomy revealed thrombosis and abscess of the wall of the lateral sinus.

The 5 cases presented reveal some of the problems that may arise with the intensive use of sulfonamide drugs. There is definite masking of the classic symptoms of any of the complications that may arise.

ABSTRACTER'S NOTE.—In consequence it is important (1) to use massive doses of sulfonamide drugs from the very onset of acute symptoms so that complete bacteriostatic control of the infection is accomplished; (2) if after a few days of this intensive therapy there is no evidence of complete subsidence of symptoms, to be on guard for the possible masking effect; (3) under such conditions, to do very early an extensive surgical operation to prevent the occurrence of intracranial complications.

PERSKY, Philadelphia.

BLUE SCLERAE, OSTEOPSATHYROSIS AND DEAFNESS. B. SEELENFREUND, Acta otolaryng. orient. **2**:25, 1946.

A case of the complete syndrome of blue scleras, osteopsathyrosis and otosclerosis is presented. The patient was a 26 year old man who complained of deafness and tinnitus of one year's duration. The scleras were distinctly blue, and there were multiple fractures of bones.

The patient's mother was deafened, and her sister showed both deafness and blue scleras.

A short discussion is included.

JENNES, Waterbury, Conn.

Pharynx

TUMOR IN THE NECK AND IN THE RETROPHARYNGEAL SPACE—NEUROFIBROMA. A. R. ALBANESE, Prensa méd. argent. **32**:1763 (Sept. 7) 1945.

In 1940 a woman aged 48 noted an increase in the size of her neck. Dysphagia appeared later. In 1942 the tumor reached its maximum size. It seemed to decrease in size temporarily when her periods reappeared after two years of amenorrhea. Apparently, an operation was performed during the early part of 1944. Before the operation, extension of the head produced dyspnea. Examination of the throat showed that the posterior wall of the pharynx was pushed forward by the tumor. Roentgenograms revealed a retropharyngeal mass pushing the trachea and esophagus anteriorly. Horner's syndrome was not present. The tumor which was removed by a Kocher incision, measured 10 by 12 by 4 cm. The histologic diagnosis was neurofibroma arising either from the cervical sympathetic or the pharyngeal plexus. The author notes that the absence of Horner's syndrome does not exclude the sympathetic origin of the tumor. In December 1944 the patient was reexamined. There was definite diminution in the volume of the neck. In the posterior wall of the pharynx, a tumor, measuring 3 by 4 cm., was seen which was either an organized hematoma or a part of the tumor which had not been removed.

SAVITSKY, New York. [ARCH. NEUROL. & PSYCHIAT.]

Larynx

APHONIA. CARL H. MCCASKEY, Ann. Otol. Rhin. & Laryng. **55**:524 (Sept.) 1946.

McCaskey discusses functional aphonia, commonly called hysterical aphonia, but which, he feels, might better be called psychosomatic aphonia. Almost any organ or organ system may be the site of hysterical manifestations, and when the basic mechanism is analyzed, some type of conversion is most commonly found; that is, an emotional problem is converted into a physical manifestation. People may be caught in a situation with which they may be unable to cope at the moment, and the emotional conflict will bring about an emotional tension and an anxiety that is intolerable. When this conflict reaches the point where it can no longer be borne, the process of conversion with the production of some physical symptom is both a symbolization of, and a solution to, the conflict which has been raging. Those who have been spoiled in childhood and those who are emotionally immature and fundamentally childish in their attitude toward life, and similar types of self-indulgent persons, will often utilize this method of escape. It may, however, appear among persons of the better integrated personality type under tremendous emotional stress, such as war, sudden catastrophe, train wrecks and other highly emotional experiences. More often it is found among those who seem to have an insufficient ability to meet the ordinary vicissitudes of life.

The site of the physical involvement is not chosen at random, but an unconscious selection has occurred and the physical symptom carefully chosen to fit the problem. The unconscious and unwitting development of the symptom by the hysterical patient differentiates him from the malingerer, who wilfully and purposely simulates his symptoms for the purpose of deception to gain his own ends. Hysterical aphonia represents a specialized form of the same mechanism mentioned before, and McCaskey cites several cases in which the loss of the voice enabled the patient to evade unpleasant situations or to direct sympathy to himself. Direct treatment of the larynx may be successful in restoring the voice, but the removal of the symptom leaves the patient with the unsolved conflicts, and these will soon be converted into symptoms somewhere else in the body, the aphonia becoming converted into a backache, anesthesia of an arm or any other hysterical phenomenon.

The treatment of this type of aphonia must be directed toward the basic emotional problem. This can often be done by an experienced, sympathetic and understanding otolaryngologist who is willing to listen to the patient's story and help him understand the underlying factors which brought about the illness. The rule is: Treat the patient as a whole and in such a way as to restore health, happiness and efficiency to the total organism, instead of removing the symptom of a single organ.

M. V. MILLER, Philadelphia.

PERIESOPHAGITIS. CHARLES C. WOLCOTT, Laryngoscope **57**:45 (Jan.) 1947.

Only cases of periesophageal infection secondary to foreign body or instrumental trauma are discussed.

Early diagnosis and prompt treatment are necessary to avoid a fatal result.

A review of a number of reported cases is included. The surgical anatomy is discussed. The diagnosis is determined by the history, the pain, the dyspnea, the swelling and the tenderness of the supraclavical space, the low grade fever and roentgenologic study.

Merely the diagnosis of perforation of the esophagus, even though there are few clinical manifestations of infection, is an indication for operation. The operation is described, and case reports are included.

HITSCHLER, Philadelphia.

Nose

AN APPARATUS FOR THE INTRODUCTION OF PENICILLIN AEROSOL INTO THE NASAL ACCESSORY SINUSES WITH A CASE REPORT OF A PATIENT WITH CHRONIC SINUSITIS. ALVAN L. BARACH, BETTINA GARTHWAITE, B. S. SOROKA and FREDERICK F. ANDERSON, Ann. Int. Med. **24**:97 (Jan.) 1946.

A nebulizing apparatus by which penicillin is instilled into the accessory nasal sinuses is described and depicted. A report of the results of treatment of a boy aged 15 years is appended. Pronounced improvement followed a combination of oral administration and aerosol inhalation of penicillin.

READING, Galveston, Texas. [AM. J. DIS. CHILD.]

POSTOPERATIVE RESULTS IN TWO CASES OF CONGENITAL CHOANAL OCCLUSION. W. L. BONHAM, Eye, Ear, Nose & Throat Monthly **25**:387 (Aug.) 1946.

The literature on congenital choanal occlusion is reviewed and comments are made on various surgical approaches to the problem. The first case was discovered at autopsy, by Otto, in 1829, but it was not until 1853 that the first clinical case was diagnosed and the condition treated surgically, by Emmert. Since then, approximately 200 cases have been described in medical literature.

Congenital choanal occlusion is described as due to persistence of a vestigial epithelial structure, the bucconasal membrane, which is formed by nasal epithelium and stomodeal epithelium, between which lies mesenchyme. It is the extent of mesenchymal resorption between the two persisting epithelial layers which determines whether the obstruction is membranous or bony.

Surgical procedures to correct this deformity are divided into two general groups: the intranasal operations and the transpalatine operations. The author utilized the intranasal approach in the 2 cases he has reported, performing a submucous resection of the nasal septum and then removing the posterior portion of the septum and the bony occluding choanal wall and its mucosal covering.

These patients were operated on in 1940 and in 1941. Follow-up examinations, including roentgen studies in which iodized oil was used as a contrast medium, were made six and four years after operation, respectively, and the good clinical results obtained originally have been maintained.

JENNES, Waterbury, Conn.

A METHOD OF OBTAINING SECRETIONS FROM NASOPHARYNX FOR DIAGNOSIS OF NASAL ALLERGY. A. G. RAWLINS, Laryngoscope **57**:95 (Jan.) 1947.

Rawlins suggests several methods of obtaining nasal secretions for the diagnosis of nasal allergy which may be used in cases in which the nose is too dry to obtain them by Hansel's method. In such cases secretions may often be present in the nasopharynx. These may be picked off the nasopharynx by forceps, or may be sucked out by using a tube of small diameter. The latter is passed either through the inferior meatus or through the mouth by lifting the soft palate. As soon as secretion enters the tube, the suction is discontinued, the tube is withdrawn, and the secretion is blown out onto a slide.

HITSCHLER, Philadelphia.

MAJOR SURGERY OF THE SUPPURATIVE PARANASAL SINUSES. CLAUDE D. WINBORN, Texas State J. Med. **42**:434 (Nov.) 1946.

Winborn directs attention to the greatly diminished role of major surgical operations in the treatment of suppurative infections of the paranasal sinuses and states that the decrease is due in part to chemotherapy; but most of the credit is

given to the rhinologist for using a more rational type of therapy in the cases of acute infection as a result of more knowledge of the anatomy and the physiology of the nasal and paranasal cavities.

Adequate conservative measures promoting intranasal drainage should be carried out before surgical treatment is considered. Indications for surgical intervention in suppurative sinus infections should be carefully evaluated. In regard to the acute stages of sinusitis, surgical intervention should be limited to the virulent, fulminating infections with serious complications present or impending. Chronic conditions which may require surgical treatment for relief are:

"1. Purulent drainage with headache and malaise which persists after adequate treatment.

"2. Optic neuritis.

"3. Extensions into neighboring regions.

"4. Existence of a focus of infection in the sinuses which stimulates disease in another region or an allergy from bacterial protein sensitization."

When surgical treatment is instituted, complete removal of all diseased tissue is important. In operations on the frontal and ethmoid sinuses the author favors the external approach.

SINGLETON, Dallas, Texas

Miscellaneous

PENICILLIN IN THE TREATMENT OF PNEUMOCOCCAL, MENINGOCOCCAL, STREPTOCOCCAL AND STAPHYLOCOCCAL MENINGITIS. WILLIAM L. WHITE, FRANKLIN D. MURPHY, JOHN S. LOCKWOOD and HARRISON F. FLIPPIN, Am. J. M. Sc. **210**:1 (July) 1945.

Seventy-one cases of acute coccic meningitis in which penicillin was administered are presented. The following conclusions seem justified.

In cases of pneumococcic, meningococcic and streptococcic meningitis penicillin was often effective after adequate sulfonamide therapy had failed to produce the desired response.

In cases of pneumococcic meningitis the presence of subcranial foci and advanced age were cardinal factors in influencing the mortality rate.

Intrathecal penicillin therapy does not appear harmful. The intracisternal route seems to be the most effective route of intrathecal administration.

Although penicillin administered by the systemic route alone may have a curative effect in selected cases, it seems preferable to supplement systemic administration with intrathecal injections of the drug made by the cisternal route.

The superiority of penicillin over other chemotherapeutic agents is most clearly demonstrated in cases of staphylococcic meningitis.

It is not unlikely that best results will be obtained through a combination of systemic administration of penicillin and sulfonamide drugs and intrathecal injection of penicillin.

HENSKE, Omaha. [AM. J. DIS. CHILD.]

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

John R. Lindsay, M.D., *President*

Lawrence J. Lawson, *Secretary*

Regular Monthly Meeting, Nov. 3, 1947

Pyridoxine (B_6) Used in the Treatment of Vertigo: A Clinical Note. Presented by Dr. Alfred Lewy and Dr. Noah Fox.

This article was published in full in the ARCHIVES (**46**:681 [Nov.] 1947).

DISCUSSION

DR. THOMAS C. GALLOWAY: What is the pharmacologic action of pyridoxine? Where specifically does it act?

DR. FRANCIS L. LEDERER: It seems unfortunate that otolaryngologists must indulge in so much empiricism and carry out therapy for which there is no apparent logical basis. Pyridoxine as employed in the treatment of vertigo is an agent for the action of which there seems to be no explanation. My associates and I have employed pyridoxine in the treatment of vertigo in a number of cases, and I feel that Dr. Lewy's presentation is conservative. Certainly, in our own experience, we have had some good results. Of course, one must always remember that the definition of what constitutes true Ménière's disease leaves much to be desired. Many patients are referred with that diagnosis, though every possible labyrinthine dysfunction may be involved. Unless physicians base their interpretations on better grounds, therefore, a good many patients will be treated in this empiric fashion, and there may be difficult times ahead for otolaryngologists. All one can conclude at the moment is that pyridoxine, whatever its action, does have a beneficial effect in some cases of vertigo.

DR. GEORGE WOODRUFF: I have had no experience with pyridoxine in the treatment of vertigo, but I believe Dr. Lewy mentioned that these patients had been treated with salt-free diets and other therapy. Dr. H. L. Williams, of the Mayo Clinic, has said that instead of a salt-free diet and ammonium chloride he used fairly large doses of potassium nitrate, and when this was done, particularly in cases of endolymphatic hydrops, it was unnecessary to limit the salt. I have found potassium nitrate of some value in certain cases.

DR. JOHN R. LINDSAY: It seems that a remedy which appears to have such wide application as this should be worth looking into. I should like to ask Dr. Lewy if he makes any distinction between attacks of vertigo from different causes, or do I understand correctly that treatment has proved effective in those of central origin as well as in those of peripheral origin? I wonder if he has treated patients who have postural vertigo from multiple sclerosis or some other known neurologic disease; does it relieve their symptoms? It is a little difficult to appreciate any single drug affecting the basic pathologic changes of true Ménière's disease, which is a hydrops of the labyrinth. The vertigo that is experienced in this condition is unpredictable, occurring at irregular intervals, which may vary from a matter of hours to one of many months.

An evaluation of therapy based on attacks of vertigo alone, in Ménière's disease, is therefore not reliable. Auditory symptoms must also be considered.

DR. O. E. VAN ALYEA: I should like to ask Dr. Lewy how long he continues treatment in those cases in which the vertigo does not respond rapidly to pyridoxine therapy.

DR. SAMUEL SALINGER: I think there are two important items that need clarification in order to fully appreciate this report. First, what is the pharmacology of this drug and what is its action? Second, in what particular type of case is it indicated, and why? Is it possible that Dr. Lewy might give some additional information on these points?

DR. ALFRED LEWY: I anticipated most of these questions. I am unable to answer most of them. I know absolutely nothing about the pharmacology of pyridoxine, and have been unable to find anything in the literature concerning its action in vertigo.

In many cases I was unable to find the cause of the vertigo; 47 were classified as instances of Ménière's disease. We believed the cause to be peripheral, presumably ectasia of the labyrinth. As to the general causes, we do not know whether it was due to toxemia or to vascular disturbance acting on the vestibular mechanism. In none was there a diagnosis of a space-occupying lesion. It would be interesting to know whether pyridoxine is effective on that basis.

In a symposium before the American Otological Society last April, Levy and O'Leary described 8 cases of (1) platybasia, (2) meningioma of the cerebellar-pontile angle, (3) aneurysm of a circumferential artery, (4) multiple sclerosis, (5) vertiginous epilepsy, (6) migraine with vertigo, (7) hypothyroidism, vertigo and personality disorder, and (8) vertigo followed by anxiety hysteria. I have had no opportunity to try this agent in vertigo of multiple sclerosis or epilepsy. I have observed migrainous patients with vertigo; the vertigo was relieved but not the migraine. I have had no opportunity to try pyridoxine in any case of intracranial disease that had been proved to be organic. Dr. Albert C. Furstenberg, who summed up the symposium, laid emphasis on the psychiatric element—for instance, in the case of anxiety hysteria or of personality disorder.

I am simply giving the clinical facts. In many cases that are studied we cannot make a diagnosis and the neurologists cannot make a diagnosis. Sometimes a focus of infection, such as an infected gallbladder, is found, and treatment directed to that source often helps. We have cured many patients without making a diagnosis.

If I do not see improvement fairly promptly, I do not continue to administer pyridoxine. Some have improved almost immediately; others may not show improvement for several days. I certainly would not carry on the treatment for three or four weeks if no improvement is apparent. Incidentally, pyridoxine is expensive.

I do not know what pathologic conditions are favorably affected.

DR. FRANCIS L. LEDERER: Have the essayists had any personal experience on this subject?

DR. ALFRED LEWY: One of the essayists had an attack of Ménière's disease that was classic, almost to unconsciousness, with absolute inability to move, with vomiting, nystagmus and complete prostration, and he was back in the office in three weeks.

Several patients showed a relapse on stopping treatment, but when treatment was resumed the vertigo disappeared. On the second occasion I have given the same dosage. Perhaps larger doses would help in some cases that are failures,

and perhaps some patients would get along on lesser doses. I have seen no ill effects after a period of five or six weeks, but I read of one death attributed to anaphylaxis following a second intravenous injection of pyridoxine; I could not locate the original publication. I have noted no ill effects, not even side effects.

Except in one case, I cannot say that either the tinnitus or the deafness was markedly improved.

I believe the product is entirely synthetic. I could learn nothing on the pharmacology—everything I have seen was in chemical formulas.

Bone Conduction as Observed in Cases of Fenestration: Physiologic Considerations. Presented by DR. ARTHUR L. JUERS.

The Weber test is discussed as a means of detecting early depression of cochlear function in some cases of fenestration. Audiometric studies of bone conduction show some lowering of threshold after fenestration, especially for the higher frequencies. This can be explained from the physiologic standpoint on the basis of bone-conducted sound reenforcing the usual compression wave within the labyrinth, the additional sound entering the inner ear through the fenestra.

Clinical evidence indicates that air-conducted sound may enter the inner ear chiefly by passing directly through the fenestra and that the tympanic membrane serves chiefly to dampen the sound pressure transmitted to the round window. Possible methods of enhancing this dampening function are mentioned.

DISCUSSION

DR. PAUL A. CAMPBELL: The Weber test, as all know, is a function of both ears, not just one ear. The result of this test is thus influenced by the situation in the ear not operated on. I should like to know how Dr. Juers controlled that ear in this study.

DR. ROBERT LEWY: It is a common observation, if one has two normal ears and does the Weber test with a finger in one normal ear, that the sound will lateralize to the side where the "conduction deafness" is thus produced. This being the case, I cannot understand why the packing placed in the fenestrated ear would not in itself produce an identical result.

DR. MAURICE SNITMAN: Did Dr. Juers state that slight pressure on the membrana tensa produced vertigo by compressing the round window inward? From personal experience, such pressure on the drum produces a tug on the tympanomeatal flap with a consequent pull on the underlying membranous canal, with resultant vertigo.

DR. H. F. KOBRAK: This is an excellent paper, which contains not only a comprehensive collection of results of previous work on bone conduction but also much new information and new interpretations. The remarks made on the Weber test corroborate what otologists have known in the past: The Weber test is unreliable and not valuable except in one condition, the shift from the bad ear into the good ear when labyrinthitis develops. Dr. Juers has shown that this test holds for the fenestrated ear.

I was glad to hear Dr. Juers's opinion on true increase of bone conduction in case of middle ear deafness. He mentioned the work of Herzog and Krainz. In my opinion their experimental work on models and on fresh temporal bones is the most elegant explanation of the increase of bone conduction.

In his last slide Dr. Juers showed a sketch of the middle ear in which the longitudinal air waves were drawn as parallel lines showing areas of compression and rarefactions, as they occur in a sound wave. It seemed to me that these

lines indicated a too short wavelength as compared with the size of the ear. An air wave of the frequency 1000 is about a foot long. This means that the important frequencies have a wavelength which is large in comparison with the structures of the ear. All studies on phase relationship between oval window, round window and new fenestra must be based on this physical fact. Maybe Dr. Juers could explain this slide a little more fully.

I want to thank Dr. Juers for such an interesting and informative presentation. It is an excellent paper which deserves a great deal of further study.

Dr. George Shambaugh Jr.: Dr. Juers has been working on this problem, which is of considerable practical application as well as of theoretic interest. We have tried to find some practical method of detecting labyrinthitis in these fenestrated patients, and in a series of cases we made daily audiometric tests of bone conduction to follow the cochlear function. We found the Weber test the most practical way to detect labyrinthitis. Second, after fenestration the mechanism of hearing is still as much of a mystery, but it is important. There are about 5 per cent of patients, apparently ideal for operation, who fail to get any improvement. There is something about the physiology of hearing in these cases which is not yet understood but which should explain the failure. I think future progress in fenestration will come largely from those who are studying the physiology of hearing after the operation in order to permit one to get the maximum hearing improvement in the operation.

Dr. Arthur L. Juers: In reply to Dr. Campbell's question, we have no way of knowing what is happening in the ear not operated on, but in trying to find a test of value for detection of early cochlear depression it is not unreasonable to assume that the ear not operated on is unchanged. The Weber test is not infallible by any means. Dr. Lewy asked a question as to packing producing lateralization to the surgically treated ear; that thought occurred to us. I tested routinely 50 patients coming through the office and approximately two thirds still lateralized the sound to the ear operated on. The majority had obtained serviceable hearing and the ears were completely healed.

Dr. Snitman asked about the fistula response to pressure against the pars tensa. That response is opposite to what one gets when pressure is applied over the fenestra. Movement is probably transmitted through the tympanomeatal flap rather than through the round window.

In answer to Dr. Kobrak's question, regarding the wavelength represented on the slide, this was just a sketch to show the possible relationship of sound phase to the two windows, and the usual proportion of wavelength to actual cochlear dimensions was not considered.

News and Comment

AN ANNIVERSARY IN CHINA

The Chengtu Eye, Ear, Nose and Throat Society, Chengtu, Szechwan, China, celebrated its tenth anniversary on Dec. 20, 1947. Dr. T. H. Lan, professor of biochemistry, West China Union University, was the guest speaker and addressed the society on the biochemistry of the blood of patients suffering from malignant tumors. Dr. K. C. Lang and Dr. E. Chan reviewed the history and the progress of the society during the past decade.

NOTICE

The Transactions of the American Otological Association, Inc. (1947, vol. XXXV) are in the hands of the printer and will be ready for distribution (at $6.00 a copy) in the near future. Orders for these Transactions should be placed as soon as possible with Dr. John R. Lindsay, 950 E. 59th St., Chicago 37.

Book Reviews

Lehrbuch für Hals-Nasen-Ohren-und Mundkrankheiten. By A. Barraud, Lausanne; F. R. Nager, Zurich; L. Rüedi, Bern; E. Schlittler, Samaden, and J. P. Taillens, Lausanne, Switzerland. Price 60 Swiss francs. Basle, Switzerland: S. Karger, Ltd., 1947.

This is a well written textbook about the ear, nose, throat and mouth. The German in it is concise and easy to read and practically translates itself to one already versed in otolaryngologic terminology.

The many illustrations and colored plates are beautifully done, giving a real life image of the usual and the unusual conditions of the ear, nose, throat and mouth.

Extreme detail has been omitted in the descriptions of many of the radical operations—for example, frontal sinusotomy—and rightly so, since the book is obviously not meant for the expert otolaryngologist, nor even for the serious postgraduate student. Also, it lacks a complete written and visual description of bronchoscopy and eosophagology such as is given generally in so many American books and in particular in that of Jackson and Jackson on otolaryngology.

There is a fine allotment of space for the more frequent diseases, with less space for the infrequent ones, giving a fairly well balanced reference book for the medical student and the general practitioner versed in the German language and continental nomenclature. It is completely modern and up to date in its theoretic considerations and its therapy and hence is of distinct value as a forward step in the rapidly changing panorama of otolaryngology.

Directory of Otolaryngologic Societies *

INTERNATIONAL

SECOND PAN-AMERICAN CONGRESS OF OTO-RHINO-LARYNGOLOGY AND BRONCHOESOPHAGOLOGY

President: Prof. Justo Alonso.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.
Place: Montevideo. Time: January 1950.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SCIENTIFIC ASSEMBLY, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman. Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Secretary: Dr. J. Milton Robb, 1553 Woodward Ave., Detroit, Mich.
Place: Chicago. Time: June 21-25, 1948.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
President-Elect: Dr. C. H. McCaskey, 20 N. Meridian St., Indianapolis, Ind.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Secretary: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore.

AMERICAN LARYNGOLOGICAL ASSOCIATION

President: Dr. Frederick T. Hill, 177 Main St., Waterville, Me.
Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia 2.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. John J. Shea, 1018 Madison Ave., Memphis, Tenn.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.

SECTIONS:

Eastern.—Chairman: Dr. J. Winston Fowlkes, 12 E. 63d St., New York 21.
Southern—.Chairman: Dr. William A. Wagner, American Bank Bldg., New Orleans.
Middle.—Chairman: Dr. Hugh G. Beatty, 150 E. Broad St., Columbus, Ohio.
Western.—Chairman: Dr. Meade Mohun, 23–2d Ave., San Mateo, Calif.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Marvin F. Jones, 121 E. 60th St., New York.
Secretary: Dr. Gordon D. Hoople, 713 E. Genesee St., Syracuse, N. Y.

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY, INC.

President: Dr. Jacob Daley, 104 E. 40th St., New York 16.
Secretary: Dr. Norman N. Smith, 291 Whitney Ave., New Haven, Conn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

THE ARCHIVES OF OTOLARYNGOLOGY is published by the American Medical Association to stimulate research in the field of otology and laryngology and to disseminate knowledge in this department of medicine.

Manuscripts for publication, books for review and correspondence relating to the editorial management should be sent to Dr. George M. Coates, Chief Editor, 1721 Pine Street, Philadelphia 3, or to any other member of the Editorial Board. Communications regarding subscriptions, reprints, etc., should be addressed, ARCHIVES OF OTOLARYNGOLOGY, American Medical Association, 535 North Dearborn Street, Chicago 10.

Articles are accepted for publication on condition that they are contributed solely to the ARCHIVES OF OTOLARYNGOLOGY. Manuscripts must be type written, preferably double spaced, and the original copy should be submitted. Zinc etchings and halftones will be supplied by the Association when the original illustrations warrant reproduction and when their number is not considered excessive.

Footnotes and bibliographies (the latter are used only in exhaustive reviews of the literature) should conform to the style of the *Quarterly Cumulative Index Medicus*. This requires, in the order given: name of author, title of article and name of periodical, with volume, page, month—day of month if the journal appears weekly—and year.

Matter appearing in the ARCHIVES OF OTOLARYNGOLOGY is covered by copyright, but as a rule no objection will be made to its reproduction in a reputable medical journal if proper credit is given. However, the reproduction for commercial purposes of articles appearing in the ARCHIVES OF OTOLARYNGOLOGY or in any of the other publications issued by the Association will not be permitted.

The ARCHIVES OF OTOLARYNGOLOGY is issued monthly. The annual subscription price (for two volumes) is as follows: domestic, $8.00; Canadian, $8.40; foreign, $9.00, including postage. Single copies are 85 cents, postpaid.

Checks, money orders and drafts should be made payable to the American Medical Association.

OTHER PERIODICAL PUBLICATIONS
of the American Medical Association

THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION—Weekly. Covers all the medical sciences and matters of general medical interest. Illustrated. Annual subscription price (three volumes): domestic, $12.00; Canadian, $13.50; foreign, $16.00. Single copies, 35 cents.

ARCHIVES OF INTERNAL MEDICINE—Monthly. Devoted to the publication of advanced original clinical and laboratory investigations in internal medicine. Illustrated. Annual subscription price (two volumes): domestic, $8.00; Canadian, $8.40; foreign, $9.00. Single copies, 85 cents.

AMERICAN JOURNAL OF DISEASES OF CHILDREN—Monthly. Presents pediatrics as a medical science and as a social problem. Includes carefully prepared reviews, based on recent pediatric literature, abstracts from foreign and domestic literature, book reviews, transactions of special societies, etc. Illustrated. Annual subscription price (two volumes): domestic, $10.00; Canadian, $10.40; foreign, $11.50. Single copies $1.00.

ARCHIVES OF DERMATOLOGY AND SYPHILOLOGY—Monthly. Devoted to advancing the knowledge of and progress in cutaneous diseases and syphilis. Publishes original contributions and abstracts of the literature on these two subjects, transactions of the important dermatologic societies, book reviews, etc. Illustrated. Annual subscription price (two volumes): domestic, $10.00; Canadian, $10.40; foreign, $11.00. Single copies, $1.00.

ARCHIVES OF NEUROLOGY AND PSYCHIATRY—Monthly. A medium for the presentation of original articles on nervous and mental diseases, with abstracts from foreign and domestic literature, book reviews, transactions of special societies, etc. Illustrated. Annual subscription price (two volumes): domestic $10.00; Canadian, $10.40; foreign, $11.50. Single copies, $1.00.

ARCHIVES OF SURGERY—Monthly. Devoted largely to the investigative and clinical phases of surgery, with monthly reviews on orthopedic and urologic surgery. Well illustrated. Annual subscription price (two volumes): domestic, $10.00; Canadian, $10.40; foreign, $11.00. Single copies, $1.00, except special numbers.

ARCHIVES OF PATHOLOGY—Monthly. A periodical devoted to the publication of original articles and general reviews in the field of pathology. Illustrated. Annual subscription price (two volumes): domestic, $6.00; Canadian, $6.40; foreign, $7.00. Single copies, 75 cents, except special issues.

ARCHIVES OF OPHTHALMOLOGY—Monthly. Includes original articles on diseases of the eye, abstracts from foreign and domestic literature, book reviews, transactions of special societies, etc. Illustrated. Annual subscription price (two volumes): domestic, $10.00; Canadian, $10.40; foreign, $11.00. Single copies, $1.00.

OCCUPATIONAL MEDICINE—Monthly. Devoted to the advancement of knowledge on the diseases of industry and to the publication of scientific investigation in this field. Illustrated. Annual subscription price (two volumes): domestic, $6.00; Canadian, $6.40; foreign, $7.00, including postage. Single copies, 75 cents.

QUARTERLY CUMULATIVE INDEX MEDICUS—Quarterly. A complete subject and author index to the worth while current medical literature of the world. Issued four times a year. Second and fourth volumes bound for permanent reference. Subscription price, calendar year: domestic, $15.00; Canadian, $17.00; foreign, $17.00.

AMERICAN MEDICAL ASSOCIATION

535 North Dearborn Street **CHICAGO 10**

CONTENTS

PAGE

Some Clinical Phenomena of Deafness in the Light of New and Old Tests of the Ear. F. Kobrak, M.D., Edgware, Middlesex, England..... 113

Progress in Esophagology. Paul H. Holinger, M.D., Chicago..... 119

The Otolaryngologic Consultant in Compensation and Liability Actions. C. Stewart Nash, M.D., Rochester, N.Y.. 127

Management of Esophageal Strictures. Claude C. Cody III, M.D., Houston, Texas..... 133

Penicillin and Streptomycin Aerosol in the Treatment of Pulmonary Disease. E. W. Hagens, M.D.; Mary Karp, M.D., and C. J. Farmer, M.A., Chicago..... 138

The Detailed Audiogram. H. A. E. van Dishoeck, M.D., and J. van Gool, Amsterdam, Netherlands..... 149

Otolaryngologic Uses of Soluble Gauze (Oxidized Cellulose). Fletcher D. Woodward, M.D., and Thomas Holt, M.D., Charlottesville, Va..... 155

Prophylactic Value of Sulfathiazole: An Experiment Designed to Test the Efficacy of Sulfathiazole Gum in Reducing the Bacterial Flora Causing Infectious Pharyngitis. Irwin S. Neiman, Ph.D., M.D., Chicago..... 158

Acute Frontal Sinusitis. Ernest D. Johnson, M.D., Alhambra, Calif..... 165

CASE REPORTS:

Solitary Neurofibroma of the Larynx. Kenneth S. Oliver, M.D.; Alfred E. Diab, M.D., and Caesar N. Abu-Jaudeh, M.D., Beirut, Lebanese Republic..... 177

Pyloric Obstruction and Stricture of the Esophagus Following Ingestion of Lye(Sodium Hydroxide Mixed with Sodium Carbonate). Donald S. Bolstad, M.D., Detroit..... 180

Radium Treatment of Cancer of Orbit and Ethmoid Cells. M. Onsi Abdeen, M.R.C.S. (England), D.L.O.R.C.S. and P. (England), Alexandria, Egypt..... 185

PROGRESS IN OTOLARYNGOLOGY. Summaries of the Bibliographic Material Available in the Field of Otolaryngology:

The Paranasal Sinuses (Concluded). Samuel Salinger, M.D., Chicago..... 189

ABSTRACTS FROM CURRENT LITERATURE..... 226

SOCIETY TRANSACTIONS:

Chicago Laryngological and Otological Society..... 232

NEWS AND COMMENT 236

BOOK REVIEWS 237

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES..... 238